ABB solar inverters

Product manual
PVS300 string inverters

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List of related manuals

PVS300 manuals	Code (English)
PVS300 user's guide	*3AUA0000100680*

Option manuals and guides	
PVS-APK-F control unit wall mounting kit installation guide	*3AUA0000100645*
PVS-APK-M control unit table stand and wireless communication kit installation guide	*3AUA0000100644*
SREA-50 Remote monitoring adapter Product Manual	*3AUA0000098875, English*
SREA-50 Remote monitoring adapter Quick installation and start-up guide	*3AUA0000098876, Multilingual*

All manuals are available in PDF format on the Internet. See *Further information* on the inside of the back cover.

Product manual

PVS300 string inverters

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1

Safety

What this chapter contains

This chapter presents the safety instructions which you must follow when installing, operating and servicing the inverter. Read these safety instructions carefully before working with the product. Failure to observe these instructions can result in physical injury or death, and may also damage the product or associated equipment.

Use of warnings

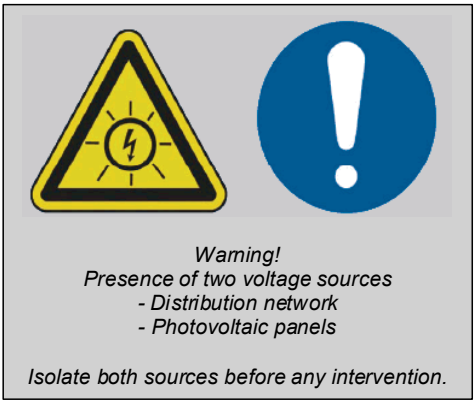
Warning symbols are used as follows:

The electrical warning informs you about electrical hazards which can cause injury, death and/or damage to the equipment.

The general warning informs you about conditions, excluding those caused by electricity, which can result in injury, death and/or damage to the equipment.

Notes draw attention to important details concerning the product or installation.

The following warning labels are attached to the right side of the inverter.



Intended use

The inverter can only be used as part of a solar system when it is permanently connected to the electrical grid.

Safety during installation and maintenance

These warnings are intended for everyone who works with the inverter, its input and output cabling, or the associated solar array(s).

Perform installation and maintenance work in accordance with the instructions in this manual, and with applicable regulations and standards in the installation country or region.

Electrical safety

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

Only qualified electricians are allowed to install and connect the PVS300 inverter!

Electrical safety rules for electricians

- Comply with all relevant electrical safety regulations of the installation country or region.
- Notice that the inverter is connected to two high voltage power sources:
  - the solar arrays at the DC connectors
  - the public electrical grid at the AC connector

- Never perform solar array or inverter installation or cabling work while the inverter is connected to the electrical grid or to the solar arrays.
- Never work on control cabling while the inverter or external control circuits are connected to power. Dangerous voltages (115 or 230 V) can exist on external control circuits connected to the relay output terminals even when the inverter is isolated from the solar arrays and electrical grid.
- Never perform insulation resistance tests or voltage withstand tests on the inverter.
- Never open the secondary cover of the inverter. Dangerous voltages may be present inside.
- Isolate the inverter from all power sources before working on it.

Isolating the PVS300 inverter from external power sources

Isolating the PVS300 inverter from external power sources	
1	Turn off the main disconnector and circuit breaker(s) at the AC distribution board.
2	Turn the DC switch on the front of the inverter to the OFF position. The DC switch does not completely isolate the DC input connectors from the solar array.
3	If applicable, turn off disconnecting switches and circuit breakers between the inverter and solar array(s).
4	Disconnect the DC cables from the inverter to ensure complete isolation from the solar array(s).
5	Disconnect the AC cable from the inverter to ensure complete isolation from the electrical grid.
	Note: Although the inverter's automatic disconnection switches isolate the inverter electronics and solar array(s) from the electrical grid, they do not completely isolate the inverter from the electrical grid. High AC voltage can still be present inside the inverter and at the AC cable terminations.
6	Disconnect any external power sources connected to the control connectors (for example, to the relay output).
7	Use a multimeter (impedance >1 Mohm) to check that there is no voltage between ground and the inverter input and output terminals.

Notes:

- The DC switch must be turned OFF before the front cover or bottom cover can be removed. The covers must be replaced before the DC switch can be turned ON.
- The DC connection terminals (DC+ and DC-) carry dangerous voltages (up to 900 V). Even in dim conditions, the solar array supplies voltage to the inverter.
- Do not disconnect DC connectors while they are under load. Protect disconnected DC connectors from the ingress of water and dirt by using DC connector sealing caps.
- The DC power switch on the front panel only turns the inverter on and off. It does not completely isolate the inverter from the solar arrays or the electrical grid.

- Dangerous voltages can be present at the terminals of the AC and DC cables when they are not connected to the inverter. Handle disconnected cables carefully.

Grounding safety (PE)

WARNING! Ignoring the following instructions can cause injury or death, increased electromagnetic interference and equipment malfunction.

Grounding safety rules for electricians

- Comply with all relevant electrical safety regulations of the installation country or region.
- Always connect protective earth (PE) to the inverter and associated equipment to ensure personal safety and electromagnetic compatibility.
- Ensure that grounding connections are sized to meet safety regulations.
- Chaining is not allowed. In multi-inverter installations, connect each inverter to the protective earth (PE) of the distribution board separately.
- Never ground the DC+ or DC- live conductors.

Notes:

- PVS300 is a transformerless inverter; the DC side and AC grid are not galvanically separated. Therefore PVS300 must not be used with solar modules which require DC+ or DC- conductor grounding.
- The inverter has two protective earth terminals which are:
  - a screw terminal connection inside the AC connector
  - a PE screw for a cable lug connection to the right side of the AC connector.
- As the touch current of the inverter may be higher than 3.5 mA AC or 10 mA DC in case of failure of the protective earthing conductor, a fixed protective earth connection is required. See *Selecting the power cables* on page *34*.

General safety

WARNING! Ignoring the following instructions can cause injury or death, or damage to the equipment.

- The inverter is not field repairable. Never attempt to repair a malfunctioning unit; contact your supplier, local ABB representative or Authorized Service Center for a replacement.
- Protect the inverter so that dust from drilling cannot enter it during installation. Electrically conductive dust inside the unit may cause damage or malfunction.
- The inverter is heavy and should be lifted by two persons wearing appropriate personal protective equipment.
- Do not obstruct the inverter cooling air inlets and outlets. The mounting plate is designed to maintain a small gap between the inverter body and the wall.

Safe start-up and operation

These warnings are intended for everyone involved in planning the operation, start up or operation of the inverter.

General safety

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

Before turning on the inverter and putting it into service:

- Take care of any permits and approvals required by local authorities.
- Inform the respective utility company about the grid connection.
- Make sure that all system equipment is suitable for operation.
- Perform necessary tests and measurements at the solar array and electrical grid side.

Safely selecting the country

When the inverter is turned on for the first time, the correct installation country must be selected by a qualified, authorized electrician so that the inverter complies with the requirements of the grid in the installation country. See *Start-up* on page *65*.

During operation:

- Monitor your system regularly. See *Output view menu* on page *79*.
- Perform the required maintenance actions. See *Maintenance* on page *83*.

2

Introduction to the manual

What this chapter contains

This chapter describes the intended audience and contents of the manual. It includes a flowchart, covering delivery to commissioning, with references to where detailed instructions can be found.

Applicability

The manual is applicable to PVS300 inverters only.

Target audience

This manual is intended for people who plan the installation, install, commission, use and service the inverter.

Read the manual before working on the inverter. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for a global readership. Both SI and imperial units are shown.

Contents of the manual

The chapters of the manual are briefly described below:

Safety explains the safety instructions for the installation, commissioning, operation and maintenance.

Introduction to the manual introduces the manual.

Operation basics and hardware description briefly describes the construction, operation and control principle.

Planning the installation describes the steps which must be completed prior to actual installation.

Mechanical installation describes the mechanical installation.

Electrical installation describes the electrical installation.

Installation checklist contains a list for final checking of the installation.

Start-up describes the start-up procedure, configuration of remote monitoring and 3-phase system monitoring.

Operation presents the control unit views, functions and messages.

Troubleshooting describes how to troubleshoot the inverter.

Maintenance explains the preventive maintenance requirements.

Decommissioning contains instructions for replacement and recycling.

Technical data contains the technical data, compliance and approvals.

Dimension drawing shows all of the relevant installation dimensions.

Navigation map presents the sequence of menus in the user interface.

Further information provides details where to find more information about the product and services.

Related documents

See the *List of related manuals* on the inside of the front cover of this manual.

Quick installation and start-up flowchart

Task	See chapter:
Plan the installation: Check ambient conditions, inverter ratings, cabling requirements, required cooling air flow, installation location, prepare equipment layout, compatibility with solar arrays and other system equipment. Select the cables and fastening components.	*Planning the installation*, page *33* *Technical data*, page *101* PVS300 user's guide Accessory manuals (if applicable): Installation guide for the remote mounting kit of PVS300 control unit User's manual, Remote monitoring adapter, SREA-50
↓	
Unpack, and check the inverter delivery. Check the condition of the sales packaging and identify your inverter. Unpack and check the condition, type and quantity of equipment provided. Only intact units may be installed and started up.	*Unpacking and checking the delivery*, page *39* Sales package and purchase order *Type designation key*, page *29* *Mechanical installation*, page *39* *Technical data*, page *101*
↓	
Check layout and prepare the installation site.	*Mechanical installation*, page *39*
↓	
Install the mounting bracket and the inverter.	*Mechanical installation*, page *39*
↓	
Route and connect the cables.	*Planning the installation*, page *33* *Electrical installation*, page *47*
↓	
Check the installation.	*Installation checklist*, page *61*
↓	
Commission the inverter.	*Start-up*, page *65* Accessory manuals (if applicable): Installation guide for the remote mounting kit of PVS300 control unit User's manual, Remote monitoring adapter, SREA-50

Terms and abbreviations

Term/abbreviation	Explanation
AC	Alternating current.
Cable lug	A connector which is crimped onto the end of cable. Also known as a crimp connector or cable anchor.
Circuit breaker	Automatic switch which will trip to OFF and protect the load circuit in the event of short circuit and overcurrent situations.
Control board	Circuit board in which the control program runs.
DC	Direct current.
EFB	Embedded fieldbus.
EMC	Electromagnetic compatibility.
EMI	Electromagnetic interference.
FBA	Fieldbus adapter.
Frame (size)	Relates to the construction type of the component in question. The term is often used in reference to a group of components that share a similar mechanical construction. To determine the frame size of a component, refer to the rating tables in chapter *Technical data*.
I/O	Input/Output.
IGBT	Insulated-gate bipolar transistor.
Inverter	A cabinet-built entity containing all inverter modules together with their control electronics, and I/O and auxiliary components. The inverter module converts the DC voltage to AC voltage. Its operation is controlled by switching the IGBTs.
I2I	Inverter to inverter communication protocol.
LED	Light emitting diode.
Main disconnector	A manually controlled power contactor or manually operated isolation switch which can be locked in the open position. It is used to cut off the power supply from the whole distribution board.
MPPT	Maximum power point tracking. Inverter software function that automatically operates the solar generator, array, string or module at its maximum power point.

Term/abbreviation	Explanation
Parameter	User-adjustable operation instruction to the inverter, or signal measured or calculated by the inverter.
Photovoltaic cell, generator, module, string, array and array junction box	In this manual, solar power system components based on photovoltaic effect are called solar cell, solar module, solar array, solar string and solar array junction box as defined below.
Protective earth (PE)	Connection of a point in the equipment, system, or installation to earth, for protection against electric shock in case of a fault.
PLC	Programmable logic controller.
RCMU	AC and DC sensitive residual current monitoring unit measures currents of L and N conductor.
RFI	Radio-frequency interference.
Solar cell	Device that converts light directly into electricity by the solar effect. Also called a photovoltaic (PV) cell.
Solar generator	The total of all solar arrays of a solar power supply system, which are electrically interconnected. Also called a photovoltaic (PV) generator.
Solar module	Packaged interconnected assembly of solar cells
Solar panel	Packaged interconnected assembly of solar cells that can be installed as a single unit and connected to other panels to form a solar array. Also called a solar module or photovoltaic (PV) module.
Solar array	Group of parallel-connected solar strings.
Solar array junction box	Device that connects outputs of multiple solar source circuits (strings) into a combined output circuit or circuits.
Solar string	Circuit of series-connected solar panels. Also called photovoltaic (PV) string.
SPD	Voltage surge protection device.
String inverter	Low power solar inverter type which typically has one or a few string inputs. Converts direct current and voltage from a solar array to alternating current and voltage to the grid.
THD	Total harmonic distortion
TL	Transformerless, no galvanic separation between DC and AC circuits.

3

Operation basics and hardware description

What this chapter contains

This chapter briefly describes the construction, operation and control principle of the PVS300 string inverter.

Overview

The PVS300 transformerless string inverter converts direct current (DC) generated by the solar arrays to single phase alternating current (AC). The AC is then fed to either the public electricity grid or to a load circuit which is connected to the public electricity grid.

PVS300 is suitable for small and medium-size solar systems.

PVS300 is designed for installation in air-cooled outdoor rated enclosures. Installation is performed with the help of a mounting plate. The DC and AC cable connections at the inverter are made with quick connectors.

Two variable speed fans operate on a demand basis. A stirring fan prevents the formation of heat pockets around the control board. A cooling fan provides air flow to the heat sink and power electronics circuit boards. The fresh air intake for the cooling fan is located in the cabling section of the inverter. A narrow gap between the PVSD300 and the mounting plate works as an air vent.

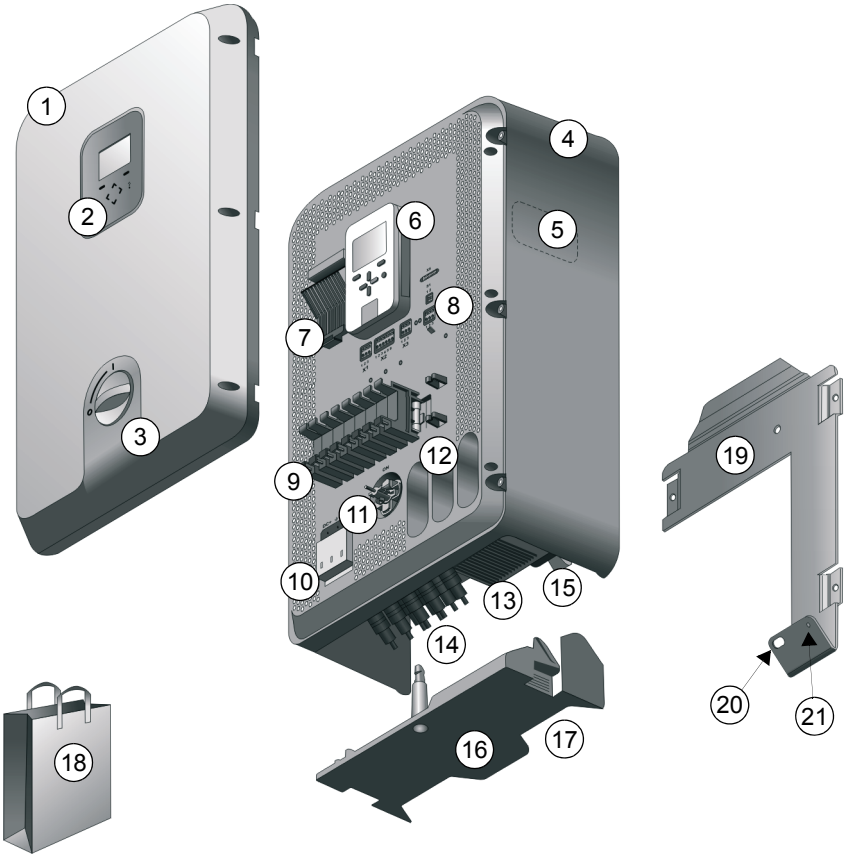
PVS300 provides comprehensive functions for system protection, system supervision and external communication.

After the inverter has been installed and commissioned, it operates automatically according to the following principle:

1. As the sun rises, the inverter wakes up when there is enough daylight for the solar modules to generate DC voltage in excess of the minimum inverter operating limit.
2. After waking up, the inverter verifies the status of the power line and then switches to the normal operating mode.
3. During operation, the inverter feeds current to the power line, and monitors both the solar arrays (DC) and power line (AC).

As the sun sets, the inverter enters sleep mode when there is insufficient daylight to generate DC voltage in excess of the minimum inverter operating limit. The inverter uses the AC power supply to keep the control unit working when the DC voltage is too low (night time).

Layout drawing



No.	Description	No.	Description
1	Front cover[1)]	12	Inlet conduits for control cables, 3 pcs
2	Control area: display, LEDs, keypad	13	Cooling fan and holder[3)]
3	DC switch handle 0=Off, 1=On	14	DC connectors
4	Main enclosure	15	AC and PE connection points
5	Type designation label	16	Bottom cover, interlocking[1)]
6	Control unit	17	Opening for cabling entrance
7	Stirring fan and holder[3)]	18	Installation items[2)]
8	Control board terminals	19	Mounting plate
9	String fuses and holders, 8 pcs	20	Point for antitheft padlock
10	DC surge protection device	21	Securing point to inverter
11	DC switch[1)]		

[1] Interlocked. The front cover and the bottom cover can be removed and replaced only when the DC switch is in position 0 (switched off). The covers can be removed separately.

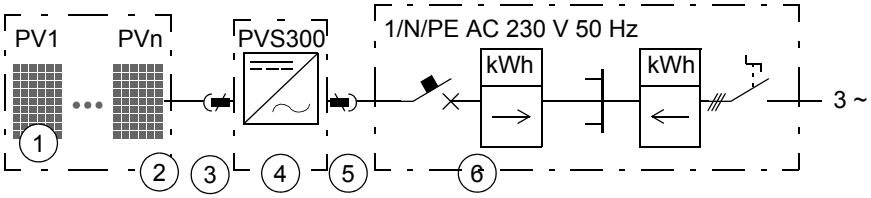
[2] Control cable clamps (3 pieces), fixing screws M4x14 (6 pieces), allen key, inverter securing screw, second PE Terminal. AC connector, DC connector sealing plugs.

[3] The cooling fan cools the heat sink and main circuit components. The stirring fan cools the control board.

Single line diagrams of the system

Block diagram of single-phase solar system

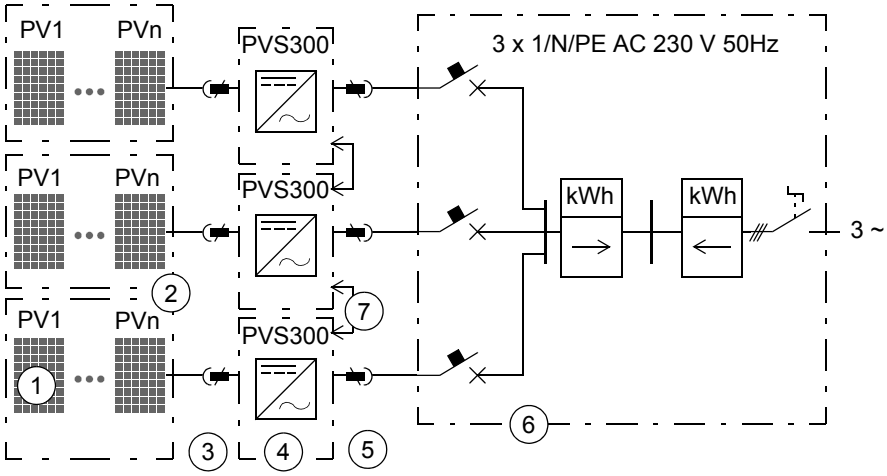
The figure below shows the single-phase system configuration.



No.	Description
1	Solar module/panel
2	String (array) of solar modules/panels
3	DC input (up to 4 parallel strings)
4	String inverter PVS300
5	AC output, single phase
6	AC distribution board

Block diagram of three-phase solar system

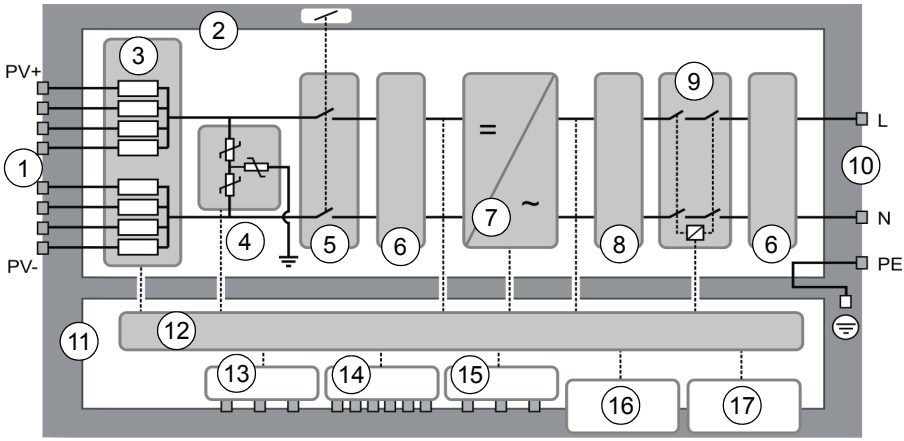
The figure below shows the three-phase system configuration.



No.	Description
1	Solar module/panel
2	String (array) of solar modules/panels
3	DC input (up to 4 parallel strings)
4	String inverter PVS300
5	AC output, three phases
6	AC distribution board
7	Inverter to inverter communication link (I2I) enabling three-phase grid monitoring

Note: Depending on the local grid code requirements, the circuit breaker at the AC distribution board can be either a single 3 pole circuit breaker or three identical single pole circuit breakers.

PVS300 block diagram



No.	Component	Description
1	DC terminals	Connection of DC cabling from solar arrays
2	Main board	Integrated circuit board onto which the main circuit components are attached
3	String fuses	Short circuit protection for string circuits
4	Surge protection	Voltage peak protection
5	DC switch	Main on/off switch of the inverter (interlocked with front and bottom covers)
6	EMI filter	Attenuation of electromagnetic interference
7	Inverter IGBTs	DC to AC conversion
8	LCL filter	Suppression of AC voltage distortion and current harmonics
9	AC contactor	Switching of AC load current
10	AC terminals	Connection of AC cabling
11	Control board	Controls and interfaces to the inverter
12	Control and monitoring	Control and monitoring circuits
13	Programmable relay output	Relay contacts for controlling external items
14	I2I link	Inverter to inverter interface
15	Monitoring interface	Performance monitoring
16	Control unit	Removable control unit
17	Status LEDs	Inverter status LEDs, behind the control unit

Features

Operation and protection features

Feature	Description/Operation
Automatic operation	The inverter wakes up and goes to sleep automatically depending on the solar radiation conditions. It connects and disconnects to the electrical grid automatically according to country requirements. The inverter studies the system operations; it generates messages and production data information to the user.
DC string fuses, monitored	String fuses provide protection for solar modules and string cabling against earth faults originating from solar side installation errors or faulty components.
DC surge protection device, monitored	A surge protection device (SPD) protects the inverter from induced voltage spikes, for example caused by thunderstorms close to the installation location. The inverter monitors SPD cartridges and informs the user when the cartridge must be replaced.
DC switch	The manually-operated DC power switch which can disconnect the inverter from solar modules under full load conditions. When turned on, the DC switch interlocks the inverter's bottom cover and front cover so that they cannot be removed.
DC reverse polarity, monitored	The inverter has a short circuit diode between the DC terminals to protect the internal electronics from reverse voltages. In case of reversed –dc and +dc connection the full short circuit current will flow through the diode, setting the DC voltage to zero. The inverter informs the user about reversed DC connection.
DC ground fault monitoring	In accordance with VDE0126-1-1; the inverter monitors the impedance between ground and DC terminals before grid connection can be established.
MPPT	Maximum power point tracking is a software function which operates the inverter automatically at the optimal operation point of connected solar modules. PVS300-TL inverters have one MPP tracker.
Residual current detection	In accordance with VDE0126-1-1; the inverter has a DC and AC sensitive residual current monitoring unit (RCMU) which measures and sums the currents of L and N conductors. If residual currents (DC or AC) are detected, the inverter disconnects from the grid.
AC Grid monitoring with anti-islanding	In accordance with VDE0126-1-1; the PVSD300 monitors the voltage and frequency of the electrical grid and can detect if the grid is operating with tolerances. The inverter also stops power conversion and disconnects from grid when missing electrical grid is detected (anti-islanding).
AC Over current trip, monitored	The inverter hardware has an over current trip function. The inverter informs the user if over current trip is performed.

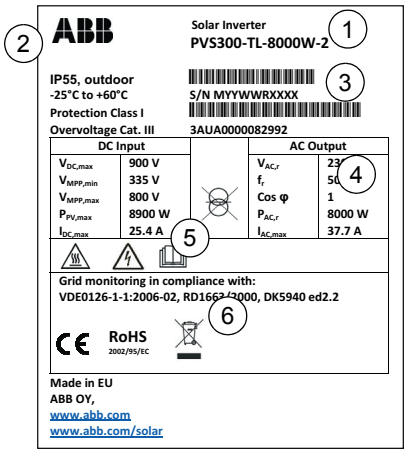
Feature	Description/Operation
AC Short circuit protection	In case of external AC side short circuit, the inverter trips to protect its electronics.
Over temperature protection	If the inverter detects potentially harmful internal temperatures, it shall temporarily limit output power by changing the DC operating point. If the internal temperature rises towards dangerous limits, power conversion and grid connection is interrupted.

User interface and communication features

Feature	Description/Operation
Control unit	The inverter has a detachable control unit which can be installed remotely, either with a wired connection or a wireless link. The control unit has a graphical display and straightforward keypad with dedicated help key. The software functions are intuitive including comprehensive system monitoring, setup assistance and help menus for the user. The control unit can be operated 24 hours per day.
Inverter to inverter communication link	Hardwired serial communication link between three PVS300 inverters. The I2I link enables inverters to share monitored information.
Three phase configuration and monitoring	With help of I2I link, three PVS300 inverters can be connected to three separate phases to form a solar system which has three phase AC output and grid monitoring. In this configuration the power output difference between phases is limited to 4.6kW.
Status LEDs	The inverter has green and red LEDs which show the operational status in addition to information provided by display. The control unit has one green/red LED. If the control unit is remotely installed the LEDs mounted on the inverter control board are visible for the user.
Relay output	The inverter's control board has an electrically isolated relay output. The relay output can be programmed ON/OFF, for example, in case of fault or when power feeding. The output signal can be externally monitored or it can command external equipment.
Remote monitoring interface	PVS300 has a hardwired serial communication link embedded fieldbus interface with Modbus RTU protocol. Other inverters and equipment including Modbus RTU can be directly connected to this serial link such as weather sensors, large displays, media converters, dataloggers etc. ABB also offers optional a remote monitoring adapter compatible with the PVS300 inverter. The adapter offers eg. a datalogger, an integrated web interface, connectivity to Ethernet and mobile networks etc.

Type designation label

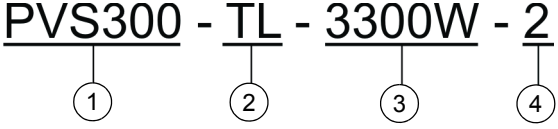
The type designation label is located on the right hand side of the inverter.



No.	Description
1	Type designation
2	Degree of protection Operating temperature range Classification of protection against electric shock by IEC 62103 Category of protection against over voltage of atmospheric origin or due to switching by EN60664-1
3	Serial number and barcode Material number and barcode
4	Ratings
5	Warnings, other information
6	Compliance markings

Type designation key

The type designation contains information on the specifications and configuration of the inverter. You find the type designation on the type designation label attached to the inverter. The first digits from the left express the basic configuration, for example PVS300-TL-3300W-2. The final digits are reserved for optional selections. The type designation selections are described below.



1	Product series
2	Construction (TL = Transformerless)
3	Nominal output power [W]
4	Nominal output voltage (2 = 200 - 240 V AC)

Optional accessories

Type designation	Description
SREA-50	Remote monitoring adapter with data logger, Ethernet port and integrated Web-browser based graphical user interface.
PVS-APK-F	Fixed control unit wall mounting kit including flush and surface mounting frames and cabling adapters.
PVS-APK-M	Mobile control unit mounting kit including communication transceivers, power source and table stand.

Connections and control interfaces

See the *Connection diagram* on page *50*.

DC input connectors

The inverter has four pairs of DC+ and DC- connectors to attach up to four separate strings of solar panels. Each string is connected to one pair of DC connectors. Correct polarity is assured by using different connector types for DC+ and DC-.

AC connector

The inverter has a single AC connector. AC current power flows to and from the inverter through this connector.

Relay output terminal X1

The inverter has one potential free relay output terminal. The inverter software includes pre-programmed functions from which the user can select the most suitable for the system. The relay output can indicate the inverter's grid connection or fault status, or it can be used to control building load circuits based on the inverter's current output power level.

Remote control unit terminal X2

The remote control unit terminal is used together with accessory kit PVS-APK-F.

I2I link terminal X3

The I2I link terminal is used to establish communication between three PVS300 inverters, each feeding into separate phases.

This communication is the basis for 3-phase monitoring function and enables 3-phase solar generator connection to the grid.

Remote monitoring terminal X4

The remote monitoring terminal is used to establish connection to the Remote monitoring adapter SREA-50.

Clamp connections for cable shields

Clamp connections for the cables shields are used to equalise the control cable shields and inverter control board potential.

RJ45 data connector X6

RJ45 (8p8c) connector is used for connecting the control unit or wireless communication (part of PVS-APK-M) kit to the inverter's control board.

Additional PE terminal

Use this terminal according to your local electrical installation guidelines and electrical installation section of this manual.

4

Planning the installation

What this chapter contains

This chapter instructs in planning the mechanical and electrical installation.

Selecting the location for the inverter

WARNING! Do not install the inverter in a location where:

- corrosive, explosive or flammable materials are used or stored
- there is a risk of mechanical impacts
- there is a lot of dust, or any conductive dust
- there is a risk of flooding or snow or sand piling
- inverter will be near to a heat source. Exposure to external heat will reduce the power output capacity and shorten the component lifetime.

- The product is designed for indoor and outdoor installations which meet the safety, ambient conditions and free space requirements.
- The installation location must be accessible in emergencies and for maintenance.
- The installation location must be out of reach of children, pets and pests.
- Avoid installing the inverter in direct sunlight.
- During operation, the inverter can produce a slight noise or vibration which could disturb people. Consider this when selecting the installation location and materials.
- The installation site must meet the specification in section *Environmental data and requirements* on page *103*.

- The installation room or cabinet must have adequate ventilation and/or cooling for all equipment inside. See *Mechanical data* on page *103*.
- There must be enough space for the inverter for proper airflow. See section *Required clearances for cooling* on page *107*. The wall or supporting structure on which the inverter will be mounted must be made of non-flammable material.
- The supporting structure and fastenings must be strong enough to support the weight of the inverter unit(s). See section *Mechanical data* on page *103*.

Selecting the power cables

General rules

Dimension the DC input power and AC output power cables according to the local regulations and the following rules:

- Select cables rated for at least 70 °C maximum permissible temperature of conductor in continuous use.
- Select a DC cable rated for at least 1000 V DC and which is approved for solar applications.
- Use only double insulated cables at both DC and AC side.
- Select an AC cable rated for at least 500 V AC.
- The AC cable must have L, N and PE conductors.
- Dimension the AC cables to carry the inverter load current with maximum voltage drop of 1 percent between inverter and AC distribution board. See also the table below.
- The minimum PE conductor cross-sectional area is 10 mm^2 for a copper (Cu) conductor. If a cable with smaller PE conductor will be used, connect an additional PE conductor of min. cross-sectional area 6 mm^2 with a cable lug to the second PE terminal of the inverter.
- When shielded cables are used, connect the cable shields to protective earth (PE) in order to meet safety regulations.

The table below shows the maximum cable length depending on the size of the phase conductor and the nominal output power.

Conductor (Cu) cross section		Maximum recommended AC cabling length per nominal output power of PSV300									
		3300 W		4000 W		4600 W		6000 W		8000 W	
mm^2	AWG	m	ft	m	ft	m	ft	m	ft	m	ft
2.5	13	10	33	9	30	NA*	NA*	NA*	NA*	NA*	NA*
4	11	17	56	14	46	12	39	NA*	NA*	NA*	NA*
6	9	25	82	21	69	18	59	15	49	NA*	NA*
10	7	42	138	35	115	30	98	25	82	15	49
*NA = Not allowed											

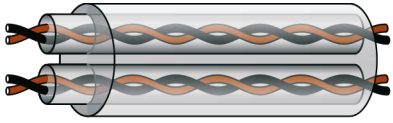
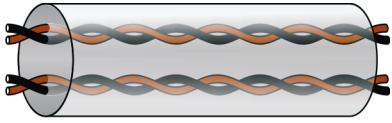
Conductor (Cu) cross section		Maximum recommended AC cabling length per nominal output power of PSV300									
		3300 W		4000 W		4600 W		6000 W		8000 W	
16	5	67	220	56	184	49	161	35	115	30	98
*NA = Not allowed											

Selecting the control cables

General rules

It is recommended to use halogen free, shielded control and data cables.

A double-shielded cable is the best alternative for low-voltage digital signals but a single-shielded twisted pair cable is also usable.

Double-shielded twisted pair cable	Single-shielded twisted pair cable
	

Signals in separate cables

Never mix 24 V DC and 115/230 V AC signals in the same cable.

Signals allowed to be run in the same cable

Relay-controlled signals can share the same cables as digital signals, provided that their voltage does not exceed 48 V. It is recommended to run relay controlled signals as twisted pairs.

Fieldbus and I2I link signals can share the same cable, provided that the Data +/- signal conductors run in the same twisted pair and both interfaces have separate functional ground conductors.

Recommended relay cable type

Cable type with a braided metallic screen (for example, Lapp Kabel ÖLFLEX or equivalent) has been tested and approved by ABB.

Recommended cable type for Modbus over EIA/RS-485

Shielded twisted pair cable (STP), impedance 100...150 ohm with 120 ohm termination resistors (for example, Lapp Kabel UNITRONIC® LiHCH (TP) or equivalent) is recommended.

Tools needed during installation

Depending on the system size, selected mounting location and materials used, mechanical and electrical installers could need the following equipment and tools:

General tools

- Personal safety equipment such as gloves, helmet, goggles, ear plugs, safety harness etc.
- Step ladders.
- Knife.

Tools for mechanical installation

- Equipment for transporting and lifting the inverter.
- Electric (hammer) drill.
- Hammer.
- Set of drill bits, wrenches, sockets and screw bits.
- Socket driver, screwdriver.
- Tape measure.
- Spirit level.
- Pencil or other marker.
- Fastening screws, plugs, etc.

Tools for electrical installation

- Hexagonal driver 3mm for securing the front cover and AC connector.
- Flat screwdriver 3mm for releasing spring terminals.
- Cable and wire strippers.
- Side cutters.
- Crimping tool and cable lugs.
- Cable marking equipment.
- Multicontact MC4 cabling tool set or MC adapter set.
- Digital multimeter (insulation tester) with DC and AC sensitive current clamp, voltage measurement (max. 1000 VDC) and continuity testing functions.

Checking solar array and inverter compatibility

Check that:

- Solar modules and DC cables used in the system are Protection Class II certified (double insulated).
- Solar modules used in the system do not require grounding of DC+ or DC- terminals.
- Solar modules used in the system are all of the same type.
- Solar strings to be connected to the inverter all have an equal configuration.
- Solar string and array maximum short circuit currents and open circuit voltages match the rated values of the inverter under local ambient conditions.
- Solar array operating voltage range lies between the limits of the maximum power point tracking (MPPT) voltage range.
- The inverter's standard 12A string fuse rating is adequate and compatible with the solar array design and installation materials. Change the string fuses to a lower or higher current rating if necessary to provide adequate system protection and functionality. See section *Warning messages* on page *95*.

Process for selecting the string fuse nominal current rating I_{FN}

- Define the nominal short circuit current I_{SC} rating from the data sheet of the relevant solar module.
- Define the maximum allowed series fuse rating or reverse current rating I_R from the data sheet of the relevant solar module.
- Define the conductor current carrying capacity I_C of the used string cable type under the planned installation conditions. See section *Selecting the power cables* on page *34*.
- Correct fuse current rating under planned installation conditions:

  $I_{FN} \geq 1.56 \times I_{SC}$

  $I_{FN} \leq I_R$ or if I_R not specified in module data sheet $I_N < 2 \times I_{SC}$

  $I_{FN} \leq I_C$

Implementing short-circuit and thermal overload protection

Protecting the inverter and AC output cable from short-circuits

The inverter has an integrated automatic AC overcurrent trip function which limits inverter damage if there is, for example, an AC side short-circuit or other overcurrent event. Install an external circuit breaker at the distribution board to protect the AC cable according to local regulations, appropriate AC line voltage and the rated current of the inverter.

Protecting the solar array and DC input cables from short-circuits

The inverter DC string fuses and short-circuit diode protect the inverter DC circuit, the DC input cables and solar modules from short-circuit situations provided that the DC cables and solar array are dimensioned according to inverter nominal DC voltage, current and string fuse ratings.

Protecting the inverter and AC output cable from thermal overload

The inverter protects itself against thermal overload provided that the cable is dimensioned according to the nominal current of the inverter. A circuit breaker should be installed on the AC distribution board side to protect AC cabling and electrical grid interface devices.

The use of external RCD

This inverter can produce current with a DC component. Where an external residual current-operated protective (RCD) or monitoring (RCM) device is used for protection against direct or indirect contact, only type B devices are allowed on the output (AC) side of this product.

In normal operation, PVS300 inverters generate up to 60 mA leakage current peaks. Therefore, if an external RCD is used, it must have a nominal rating of at least 60 mA per inverter which is connected to it.

5

Mechanical installation

What this chapter contains

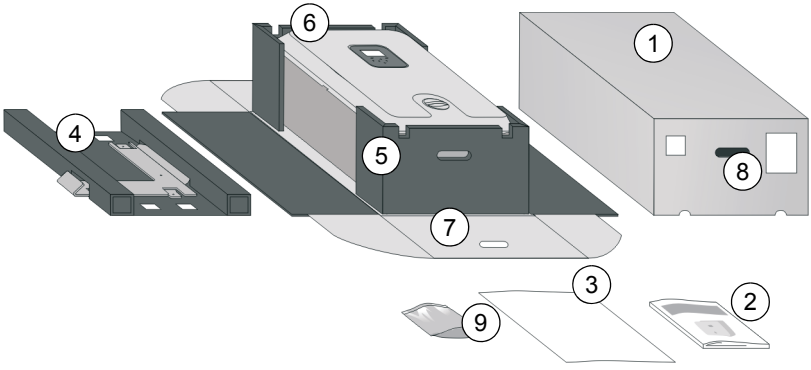
This chapter describes how to check the installation location and inverter delivery, the installation tools required and the mechanical installation procedure for the inverter.

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

Checking the installation site

See section *Planning the installation* on page *33* for all steps which must be completed during the planning phase.

Unpacking and checking the delivery

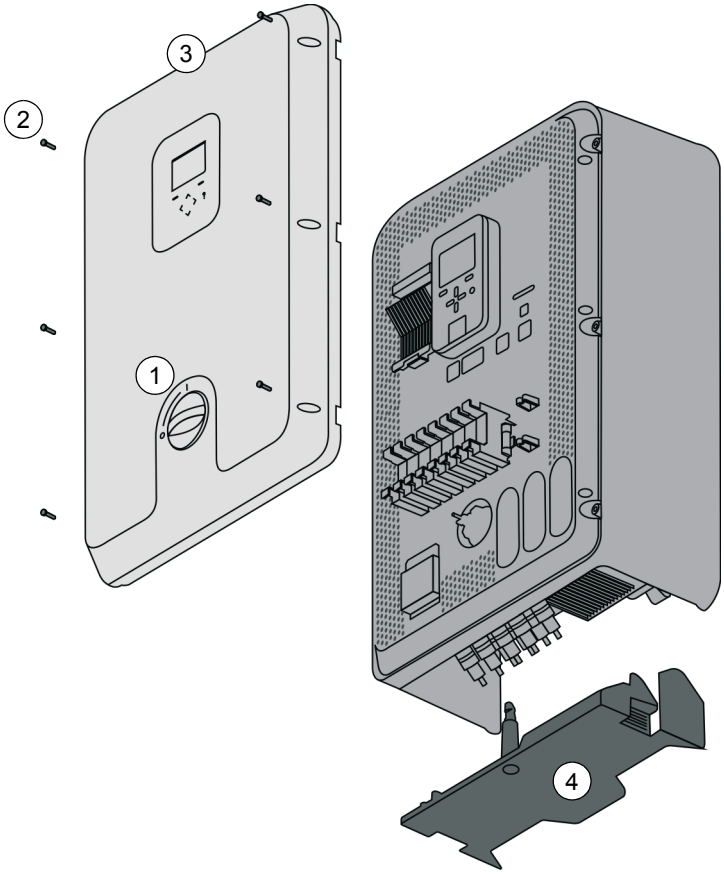


No.	Description of sales packages features and materials delivered
1	Lid of package
2	PVS300 product manual
3	PVS300 user's guide
4	Mounting plate
5	Removable packaging supports
6	Inverter
7	Base of package
8	Labels of sales package
9	Installation accessories

1. Check that the package is not damaged.
2. Before opening the package, check the sales package labels to verify that the delivery is of the correct type.
3. Transport the inverter in its packaging to the installation site.
4. Avoid removing items from the sales package until you are ready to install them.
5. Read the documentation and keep it available at the installation site.
6. Store the PVS300 user's guide near the inverter so that it will be readily available for users to refer to it.
7. Check that installation accessories (DC connector sealing plugs, AC connector, inverter securing screw, second PE terminal, cable clamps, allen key and fastenings) are present in the package.

See sections *Type designation label* and *Type designation key* on page 29.

Removing and replacing the front cover and bottom cover



The front and bottom covers can only be removed and replaced when the DC switch (1) is set to the OFF position. It is not possible to turn the DC switch, or operate the inverter, when either of the covers is removed.

The front and bottom covers can be removed separately; they do not always need to be removed together.

Removing and replacing the front cover

To remove the front cover, turn the DC switch (1) to the OFF position, remove the six fastening screws (2). Slide the front cover (3) towards you.

To replace the front cover, ensure that the DC switch is in the OFF position and slide the front cover to engage with the DC switch. Fit the six fastening screws.

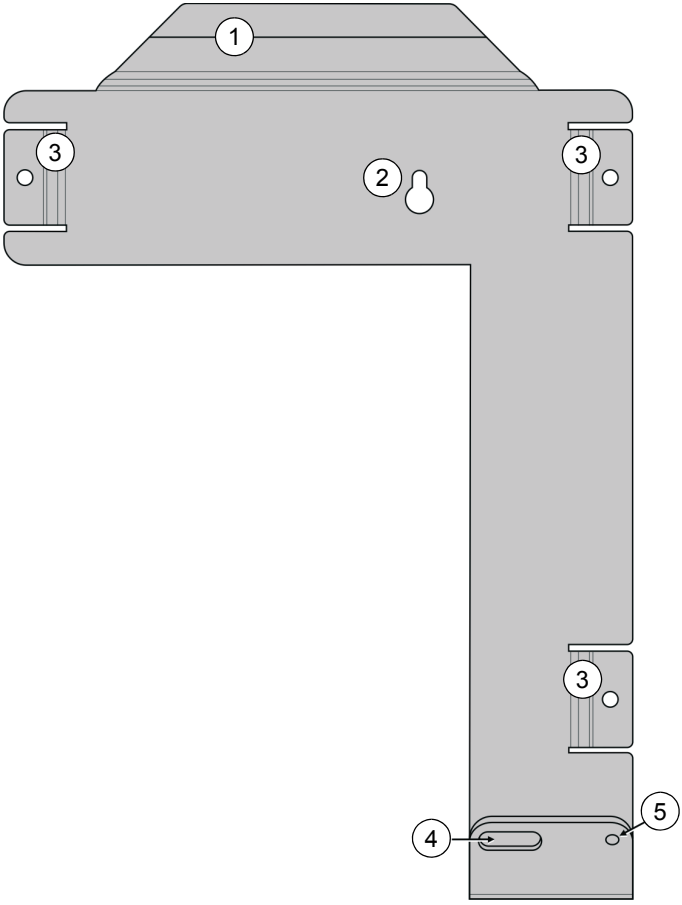
Removing and replacing the bottom cover

To remove the bottom cover, turn the DC switch (1) to the OFF position and then gently pull the bottom cover (4) downwards.

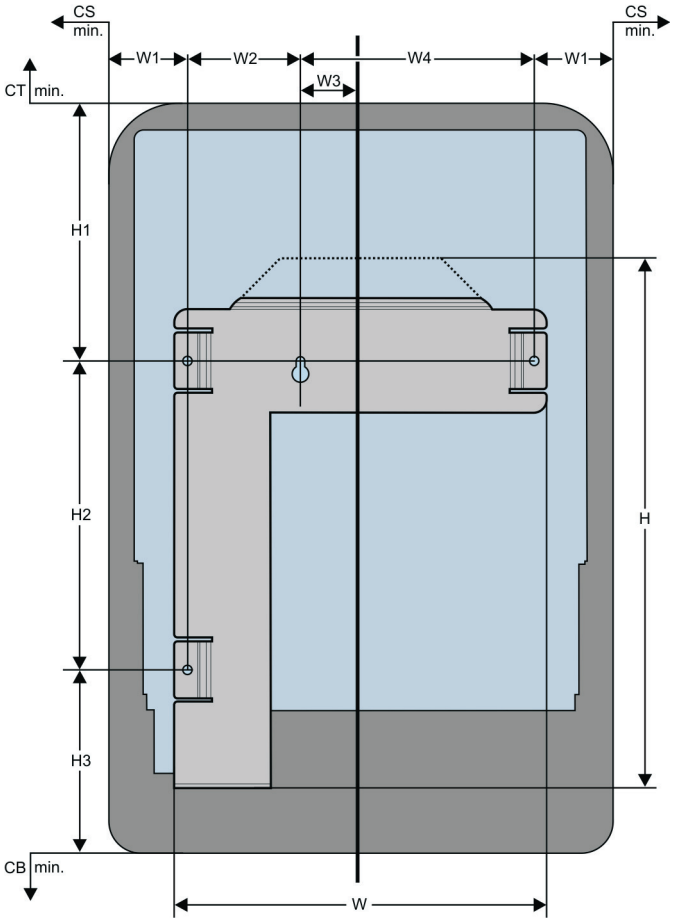
To replace the bottom cover, ensure that the DC switch is in the OFF position and gently push the over upwards.

Installing the mounting plate onto the supporting structure

See section *Dimension drawing* on page *105* for details of dimensions, weights and free space requirements.



No.	Description
1	Cantilever support for inverter hanging
2	Pilot securing point, ∅ 6.5 mm
3	Wall securing points, 3pcs, ∅ 6.5 mm
4	Slot for antitheft padlock
5	Securing point to inverter
6	Bottom hook for inverter support



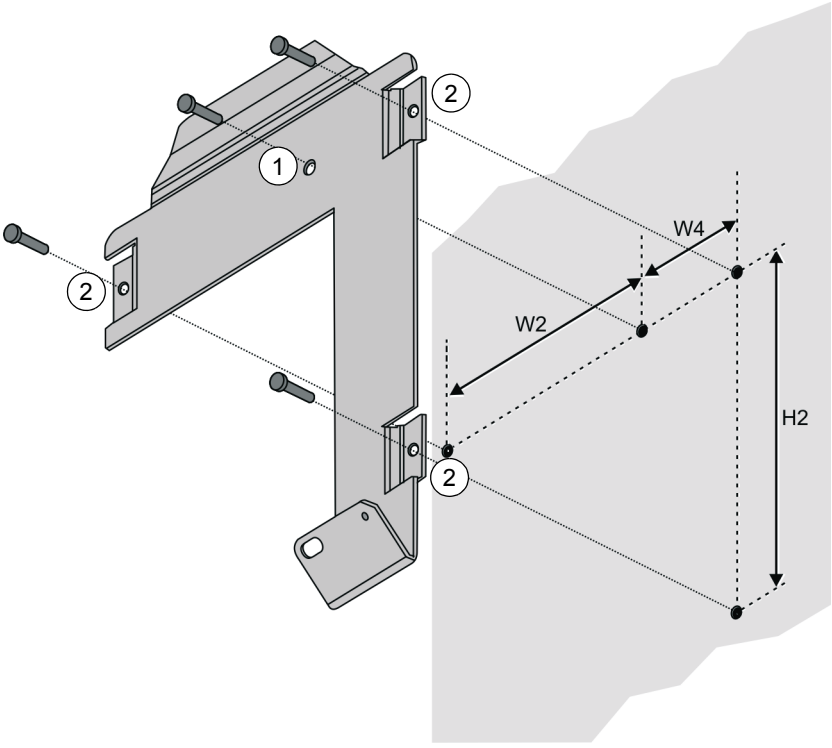
	Mounting dimensions									Clearances		
	H	H1	H2	H3	W	W1	W2	W3	W4	CB	CS	CT
mm	411	200	239	143	288	61	87	47	181	500	250	250
inches	16.2	7.87	9.41	5.63	11.3	2.40	3.43	1.85	7.13	19.7	9.8	9.8

Installation sequence

Note: Ensure that dust from drilling will not enter the inverter during the installation.

Note: When a self-carrying wall surface, such as a brick wall, is not available:

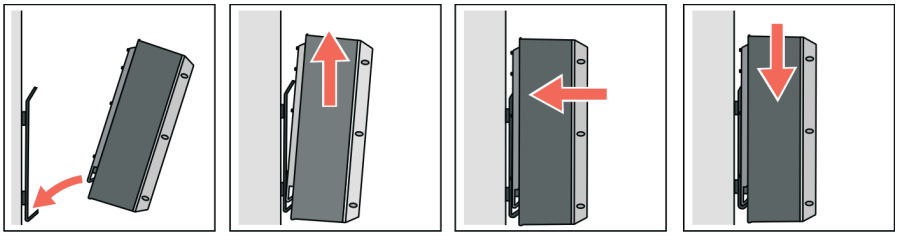
- If stud work can be located behind the wall surface and the mounting plate holes can be aligned with it, the mounting plate can be fastened to the stud work.
- If suitable stud work cannot be located, a strong supporting structure (for example, stud work, boards, railings) must be prepared on the wall surface.



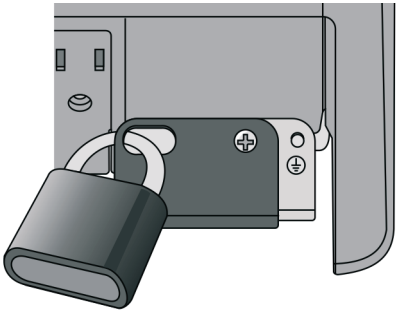
1. Use the pilot securing point (1) to temporarily hang the mounting plate in its intended location. The vertical centre of the inverter's keypad will be at the same height as the pilot securing point and a small distance (W3) horizontally offset to the left of it.
2. Check that the mounting plate is straight, then mark the securing points (2) to the wall.
3. Drill holes in the marked positions and fasten the mounting plate to the wall or mounting base.
4. Either fully tighten or completely remove the pilot securing screw.

Installing the inverter onto the mounting plate

Installation sequence



1. Remove the bottom cover from the inverter. See *Removing and replacing the front cover and bottom cover* on page *41*.
2. With the top of the inverter tilted slightly towards you, lift it up so that the bottom hook of the mounting plate goes into slot on the back of the inverter
3. Tilt the inverter backwards so that it is almost vertical.
4. Slide the inverter upwards and hook it onto the cantilever support.
5. Lower the inverter so that it is supported by the mounting plate.
6. From below, check that the securing point and antitheft padlock holes of the inverter and mounting plate are correctly aligned.
7. Fit the locking screw to fasten the inverter to the mounting plate.
8. If additional security is required, the inverter can be locked to the mounting plate with a padlock. Check that the bottom cover can be fitted and removed with the padlock installed.



Note: Replace the bottom cover after cabling has been installed and commissioned.

6

Electrical installation

What this chapter contains

This chapter describes the electrical installation process for the inverter. It explains how to fit connectors and to perform cabling. It also presents the purpose and pinout of each connector.

See section *Safety during installation and maintenance* on page *10*.

Isolate the inverter from all power sources during installation and cabling work. See *Isolating the PVS300 inverter from external power sources* on page *11*.

See section *Technical data* on page *101*.

Make sure that you have all necessary tools. See *Tools needed during installation* on page *36*.

See *Selecting the power cables* on page *34*.

See *Selecting the control cables* on page *35*.

WARNING! The work described in this chapter may only be carried out by a qualified electrician. Follow the instructions in chapter *Safety* on page *9*. Ignoring the safety instructions can cause injury or death, increased electromagnetic interference and equipment malfunction.

Note: The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the inverter may experience problems that the warranty does not cover.

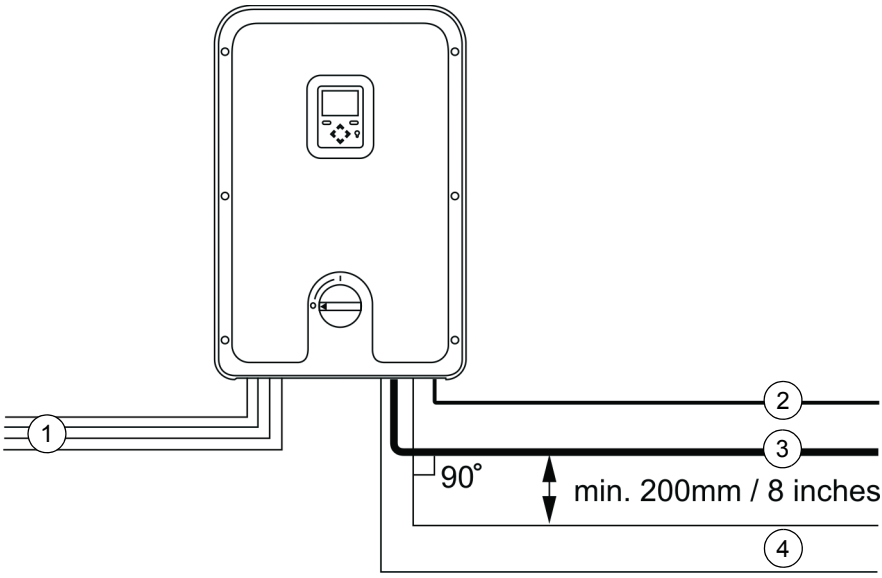
Routing the cables

General rules

Ideally, the input, output and control cables should be installed on separate trays.

If control cables must cross over power cables, arrange them at an angle as near to 90 degrees as possible. Try to ensure that control cables and the AC output cable are kept at least 20 cm (8 inches) apart. Do not run any cables behind the inverter.

Metal cable trays must be electrically bonded to each other and to the grounding electrodes. Aluminium tray systems can be used to improve local equalizing of potential.



No.	Cable type
1	DC input cables
2	PE cable
3	AC output cable
4	Control cables

Checking the insulation of the assembly

Note: The inverter periodically measures the impedance between the DC terminals and ground. If the impedance is less than 900 kOhm, a fault message is generated and grid connection is prevented. The inverter is also equipped with overvoltage protection devices on both the DC and AC sides.

Inverter

The inverter has been tested for insulation between the main circuit and the chassis (1500 V rms 50 Hz for 1 second) at the factory. Do not perform any additional voltage tolerance or insulation resistance tests, for example with hi-pot or megger, on any part of the inverter.

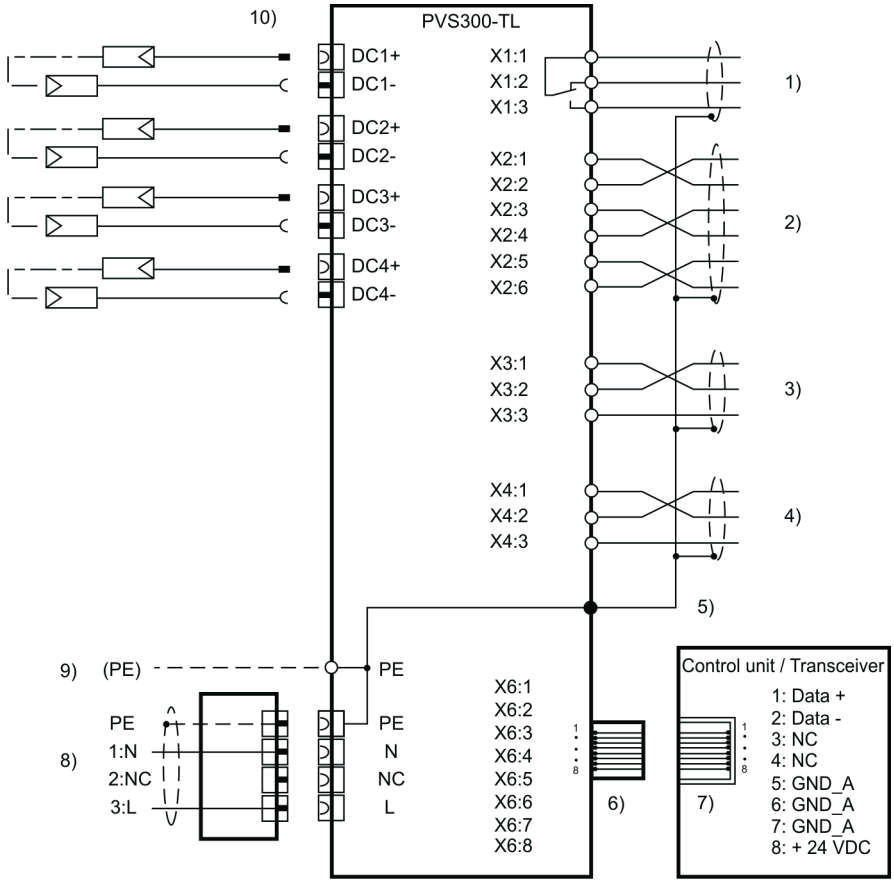
AC output cable

Check the insulation of the AC output cable is in accordance with local regulations before connecting it to the inverter.

Solar generator

Check the insulation of the solar generator is in accordance with local regulations and the manufacturer’s instructions. The solar generator must be completely disconnected from the inverter during the insulation check.

Connection diagram



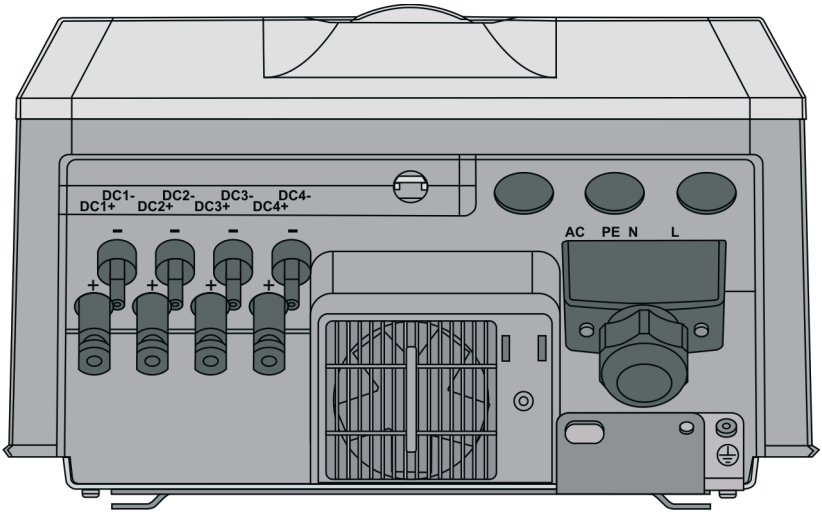
	Description		Description
1	Relay output terminal (optional)	6	RJ45 data type 8P8C plug
2	Remote control unit terminal	7	RJ45 data type 8P8C jack
3	I2I link terminal	8	AC cable connector
4	RS-485 embedded fieldbus interface	9	Additional PE terminal*
5	Clamp connections for cable shields	10	Input DC + and - connectors

* Required if the conductivity of the primary PE conductor is insufficient. See *Selecting the power cables* on page *34*.

Connecting the power cables

See section *Selecting the power cables* on page *34*.

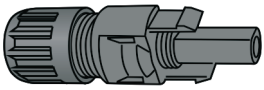
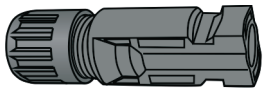
Connection area layout



	Description
1	Negative DC inputs, female panel receptacles, 4 in parallel
2	Positive DC inputs, male panel receptacles, 4 in parallel
3	Feedthrough rubber grommets for control cables, 3 pcs.
4	AC cable connector for Line, Neutral and Protective Earth conductors
5	Place for additional PE cable and cable lug, M6 thread

DC cabling connection procedure

	Description
1	Turn OFF the DC switch on the inverter front panel and isolate the inverter from all possible power sources. See *Isolating the PVS300 inverter from external power sources* on page *11*.
2	The manufacturer's type codes for required MC4 cable connectors:

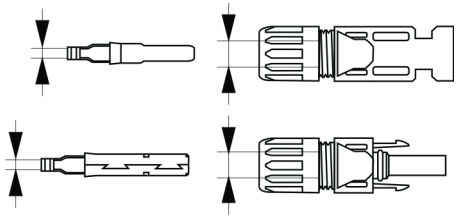
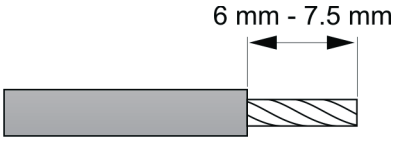
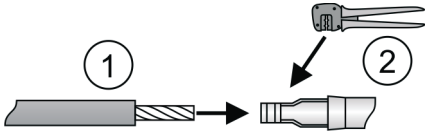
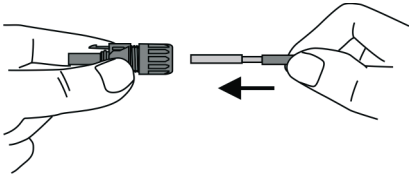
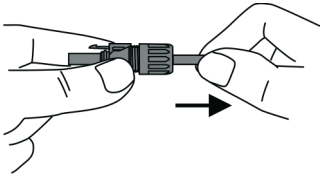
PV-KBT4 Used for connecting to DC+ at the inverter		**PV-KST4** Used for connecting to DC- at the inverter	

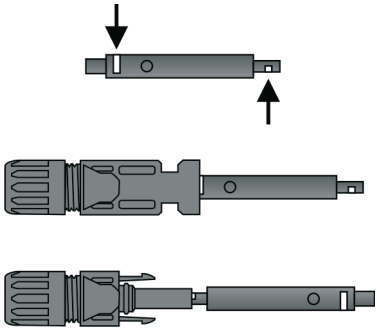
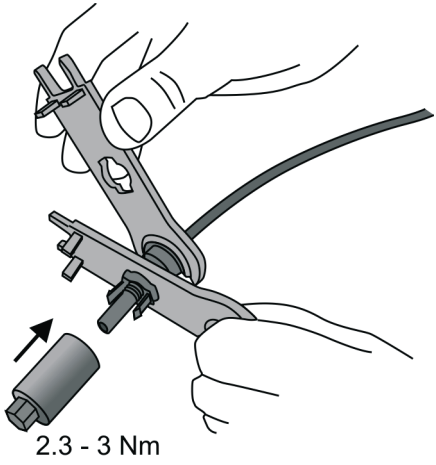
3	Check that the Multi-contact MC4 connectors are properly assembled to the DC input cables. For assembly instructions, see *DC cabling connection procedure* on page *52*.
4	Check that the DC cables are marked with the string number and polarity (+ or -). Markings must be permanent so that they will be legible throughout the lifetime of the inverter.
5	Check for correct polarity of the strings at the MC4 connectors.
6	Isolate DC input cabling from the solar array.
7	Remove the bottom cover. See *Removing and replacing the front cover and bottom cover* on page *41*.
8	Remove sealing caps from DC + and DC- receptacles on the inverter which will be used. Do not throw the caps away; store the sealing caps at the installation site.
9	Visually check that the cable connectors are compatible with the corresponding inverter receptacles.
10	Connect the strings to the inverter one string at a time, starting with connectors DC1+ and DC1-. Avoid making sharp bends in the cables close to the connectors.
11	Proceed to AC output cabling procedure

Assembling the DC connectors to the cables

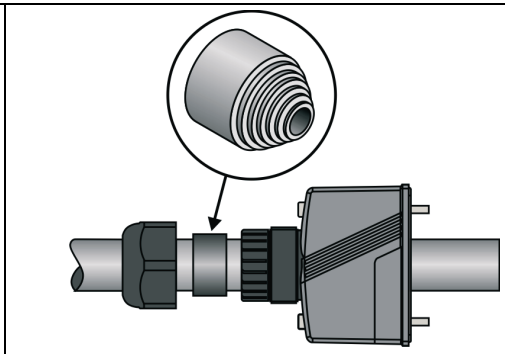
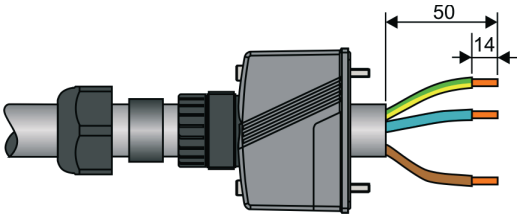
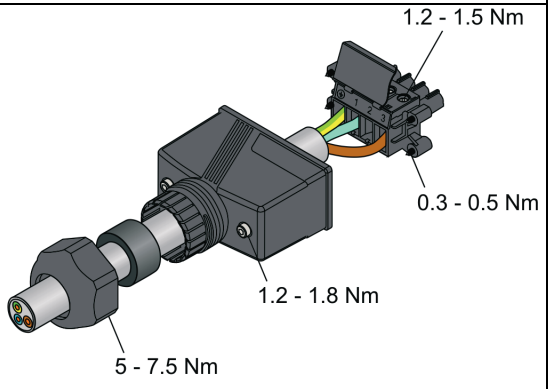
WARNING! For protection against electric shock, the DC connectors must be completely isolated from the power supply during assembly.

	Description
1	Check that the DC cables are isolated from power. See *Isolating the PVS300 inverter from external power sources* on page *11*.

	Description	
2	Use connector type PV-KBT4 for the DC+ connection and connector type PV-KST4 for the DC- connection.	
3	Check that the cables are of the right type and diameter. Check that the conductor diameter corresponds to the internal diameter of the metal contact.	
4	Strip the insulation to expose 6 mm - 7.5 mm of the conductor. Take care not to cut individual conductor strands.	
5	Insert the conductor into the metal contact and then crimp the connection. Check the connector manufacturer's instructions if required (Multi-Contact AG). See www.multicontact.com.	
6	Push the crimped metal contact through the cable gland and into the body of the plug or socket until it engages.	
7	Pull lightly to check that the contact has properly engaged.	

	Description	
8	Insert the test pin with the corresponding side into the socket or plug. If the contact is properly assembled, the white marking on the test pin must still be visible.	
9	Screw on the cable gland hand-tight and then tighten it to the correct torque.	

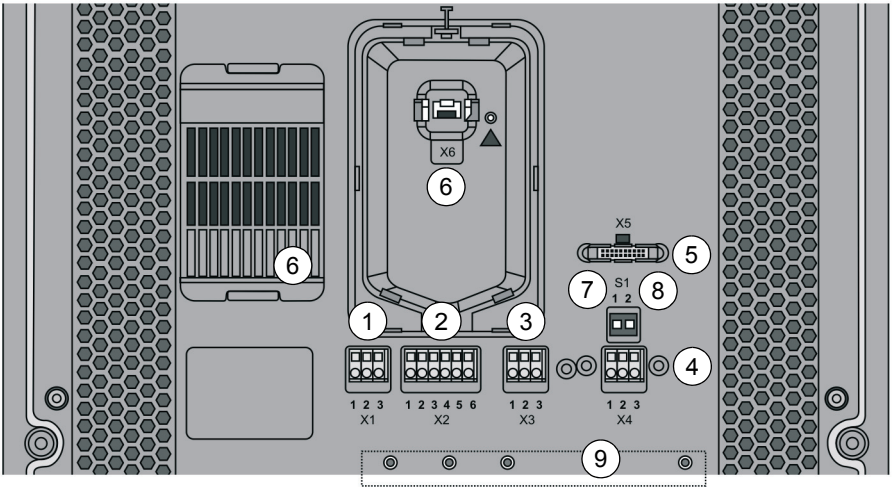
AC cabling connection procedure

	Description	
1	Isolate the inverter from all possible power sources. See *Isolating the PVS300 inverter from external power sources* on page *11*.	
2	Insert AC cable through AC connector body and multilayer rubber grommet. Discard unused parts of the rubber grommet.	
3	Strip cable and it's conductors. If cable screen/shield is used as PE conductor, mark the screen with yellow/green insulation tape.	
4	Implement the steps below: 1. Connect PE (ye/gr), N (blue) and L (brown) conductors firmly to the terminal, push connector's terminal inside the housing. 2. Secure terminal to the housing with 2 screws at both sides. 3. Slide rubber grommet inside housing, secure cable gland firmly to the housing.	
5	Attach the AC connector to inverter and secure with 2 screws and 3mm hexagonal driver.	
6	If necessary, attach an additional PE connector with cable lug to the second PE connection point.	
7	Proceed to *Connecting the control cables* if required.	
8	Push in the bottom cover if no other cabling needs to be installed.	

Connecting the control cables

See section *Selecting the control cables* on page *35*.

Connection area layout



	Description
1	X1 spring terminal, programmable output relay interface for external control equipment.
2	X2 spring terminal, RS-485 interface for remotely installed control unit.
3	X3 spring terminal, RS-485 I2I interface for communication purposes between 3 inverters in 3~ system.
4	X4 spring terminal, RS-485 embedded fieldbus interface.
5	X5 connector, for ABB Fieldbus adapters (not in use).
6	X6 RJ45 data type 8P8C plug connector, RS-485 Interface for local installation of Control Unit or optional wireless transceiver.
7	S1:1 Selector switch, not in use, default always OFF.
8	S1:2 Selector switch for termination of embedded fieldbus at the end of the network by switching ON, default OFF.
9	Nut inserts for clamp connectors used for connecting cable shields to protective earth.

Output relay, terminal X1

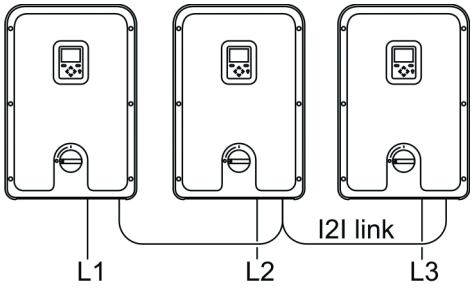
	Pin	Name	Description
	X1:1	RO_COM	Relay output, common
	X1:2	RO_NC	Relay output, normally closed
	X1:3	RO_NO	Relay output, normally open

Control unit remote installation, terminal X2

At inverter control board				At remote location RJ45 data type 8P8C plug connector (option)			
Name		Pin		Pin		Name	Description
Data +		X2:1		1		Data+	Inverter RS-485 transmit data
Data -		X2:2		2		Data-	Inverter RS-485 receive data
GND_A		X2:3		3		NC	No connection
+24V_A_1		X2:4		4		NC	No connection
GND_A		X2:5		5		GND_A	Functional ground, isolated /
REM_CTL_ENA		X2:6		6		GND_A	Ground for external RS-485 adapter
				7		GND_A	
				8		+24V	

Inverter to inverter link, terminal X3 (I2I)

Pin	Name	Description
X3:1	Data +	Inverter RS-485 transmit data
X3:2	Data -	Inverter RS-485 receive data
X3:3	GND_A	Functional ground, isolated

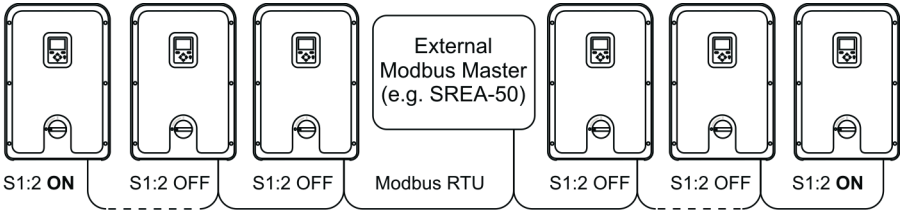


Embedded fieldbus interface, terminal X4

Pin	Name	Description
X4:1	Data +	Inverter RS-485 transmit data
X4:2	Data -	Inverter RS-485 receive data
X4:3	GND_A	Functional ground, isolated

Embedded fieldbus interface, termination resistor switch

Switch	Name	Description
S1:1	BIAS_ENA	Not used, default OFF
S1:2	TER_ENA	120 Ohm termination resistor enable, Switched ON at the end of the embedded fieldbus network, default OFF



Connection procedure

1. Remove the front and bottom covers. See *Removing and replacing the front cover and bottom cover* on page *41*.
2. If necessary, fit DC connectors to the ends of the cables coming from the solar strings. See *DC cabling connection procedure* on page *52*.
3. Connect the DC cables to the inverter. See *DC cabling connection procedure* on page *52*.
4. Attach the AC connector to the AC cable, connect it to the inverter and complete the AC cabling to the distribution board. See *AC cabling connection procedure* on page *55*.
5. If necessary, install an additional protective earth (PE) connection with a cable lug to the additional PE securing point. See *Selecting the power cables* on page *34*.
6. Connect control cables through the inlet conduits as required. Use the cable clamps supplied to connect the cable shields to protective earth (PE). See *Connecting the control cables* on page *56*.
7. Check that all wiring is correct, safe and secure.
8. Replace the front and bottom covers. See *Removing and replacing the front cover and bottom cover* on page *41*.

7

Installation checklist

What this chapter contains

This chapter contains an inspection list for checking the mechanical and electrical installation of the inverter before start-up.

Checklist

Go through the checklist with another person. Follow the instructions given in chapter *Safety* on page *9* before you work on the inverter.

Site owner and contact details:	**Installation company and address:**
Site address:	**Installers' names and contact details:**
	1.
	2.

Installed inverter types:			
☐	PVS300-TL-3300W-2 QTY:____pcs.	☐	PVS300-TL-4000W-2 QTY:___pcs.
☐	PVS300-TL-4600W-2 QTY:____pcs.	☐	PVS300-TL-6000W-2 QTY:___pcs.
☐	PVS300-TL-8000W-2 QTY:____pcs.		

Mechanical installation (see *Mechanical installation* on page *39*)	
	Check that:
☐	The mechanical installation and markings correspond to the system's layout and design drawings.
☐	The installation location is properly selected.
☐	There is sufficient free space around the unit (see *Dimension drawing* on page *105*).
☐	The cooling air is able to flow freely (see *Required clearances for cooling* on page *107*).
☐	The ambient operating conditions are allowed (see *Environmental data and requirements* on page *103*).
☐	The inverter is properly fastened to the installation base and secured to mounting plate.
☐	There are no tools, foreign objects or dust from drilling outside or inside of the inverter.
☐	The type labels or the inverters are intact and visible for the user.
☐	The PVS300 user's guide is situated at the inverter where users can find it.

Electrical installation (see *Electrical installation* on page *47*)	
	Check that:
☐	The electrical installation and markings correspond to the system's wiring diagrams.
☐	The electrical installation and markings correspond to the AC distribution board wiring diagrams.
☐	The electrical ratings of solar array and other system components are compatible with inverter.
☐	The solar array and string voltages are not exceeding the nominal input voltage of the inverter.
☐	The AC line (grid) voltage matches the nominal output voltage (230 V AC) of the inverter.
☐	The DC power cable connections at DC+ and DC- connectors and their locking are OK.
☐	Unused DC input connectors have sealing caps on.
☐	The DC string fuses have adequate nominal ratings (see *DC Input data and solar requirements* on page *101*).
☐	There are string fuses inserted in every input of the inverter.
☐	The insulation of the assembly is sufficient. See *Checking the insulation of the assembly* on page *48*.
☐	The inverter has a proper connection to Protective Earth. See *Grounding safety (PE)* on page *12*.
☐	The AC power cable connections at L1, N and PE and their tightening torques are OK. See *AC cabling connection procedure* on page *55*.
☐	The power cables are routed separately from other cables. See *Routing the cables* on page *48*.
☐	The external control connections to the inverter are OK. See *Connecting the control cables* on page *56*.

Electrical installation (see *Electrical installation* on page *47*)	
☐	The external line circuit breakers are adequately sized. See *AC Output data and grid requirements* on page *102*.
☐	The AC distribution board is installed, wired and inspected correctly and according to local regulations.
☐	All shrouds and covers are in place and secured.

Serial numbers of installed inverters:	
Installation checked (DD/MM/YYYY):	
Installers' signatures:	

8

Start-up

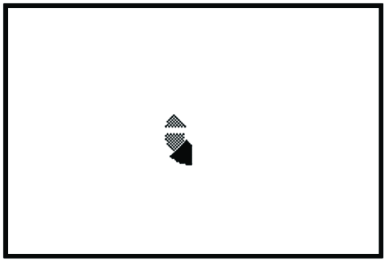
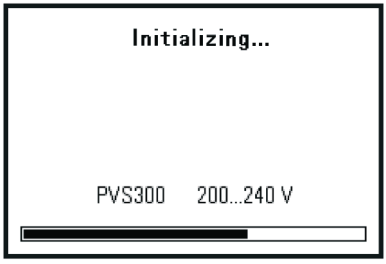
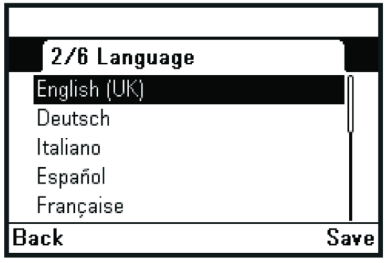
What this chapter contains

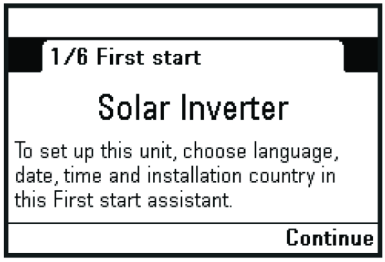
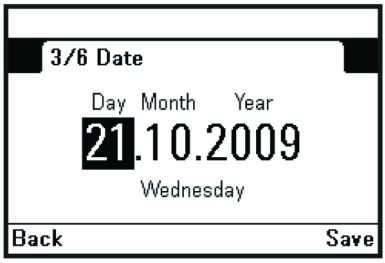
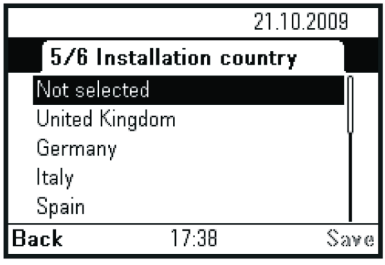
This chapter describes the start-up procedure of the inverter.

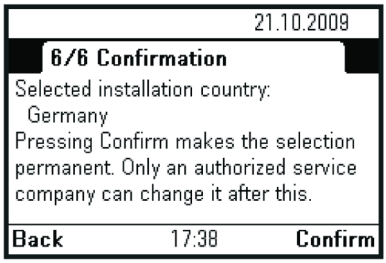
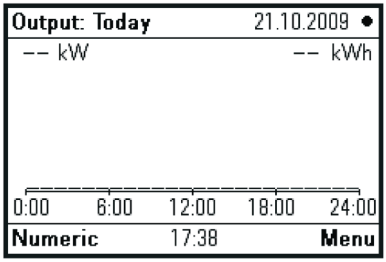
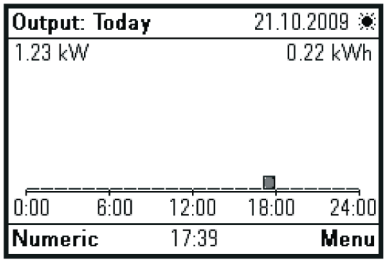
WARNING! Only qualified electricians are allowed to perform installation, cabling or testing work on the inverter!

The safety instructions in chapter *Safety* on page *9* must be followed during the installation and start-up procedure.

Primary checks	
Note: The first start-up procedure is recommended to be performed before using the wireless installation option of the control unit.	
☐	Check that the mechanical and electrical installation of the inverter is correct. See chapter *Installation checklist* on page *61*.
☐	Check that the mechanical and electrical installation of the rest of the solar system is finished and inspected.
☐	Check that the grid owner (or other local authority) has been informed about the planned grid connection of the solar system and that the plan has been approved.
☐	Check that the solar array is receiving adequate sunlight during the start-up procedure. **Note:** Although the start-up procedure and set up of the inverter is possible without daylight, it is not possible to verify correct functioning of the solar array and grid feeding without adequate sunlight levels.

First start-up		
☐	Switch ON the AC line circuit breaker at the AC distribution board.	
☐	The control board and graphical display wakes up.	
☐	The boot screen appears with a counterclockwise rotating arrow.	
☐	After 10 seconds, the splash screen appears for a few seconds.	
☐	Select the user language with the Up or Down Arrow keys.	

First start-up		
☐	First start assistance appears automatically to the screen if the inverter has been powered up for the first time after factory tests. First start assistance also appears automatically if the unit has been powered up but the first start-up settings have not been confirmed by the user. English is the default user language.	
☐	Press right softkey to continue forward.	
☐	Set the date with the Up or Down Arrow keys. Use the Right or Left Arrow keys to move between the Day, Month and Year.	
☐	Press the right softkey to Save the date and to proceed forward.	
☐	The date appears on the upper right part of the status bar. Set the time with the Up or Down Arrow keys. Use the Right or Left Arrow keys to move between the Hours, Minutes and Seconds.	
☐	Press the right softkey to Save the time selections and to proceed forward.	
☐	The time appears in the middle of the Soft Key bar. Select the installation country with the Up or Down Arrow keys. The correct installation country must be selected otherwise correct grid connection parameters are not activated and the inverter shall not start operation. If the correct installation country is not in the list, contact your inverter supplier and verify that the inverter can be used in your country.	
☐	Press the right softkey to Save the Installation Country selection and to proceed forward.	

First start-up		
☐	Check the Date, Time and Installation country selections.	
☐	Navigate Back with the left softkey if corrections are required.	
☐	Press the right softkey to confirm installation country. **Note:** After confirmation only authorized ABB service partners can make modifications to Installation Country. The inverter shall update internal settings and it shall be ready for automatic operation.	
☐	The “Output: Today” view shall appear in the display.	
☐	Turn the DC switch ON to position 1.	
☐	When adequate DC voltages are available from the solar array, the inverter switches to get its power from the solar array side. The inverter will then make a series of system safety checks. If safety checks are OK the inverter will connect to the AC grid.	

Setting up remote control unit interface	
☐	For remote installation with a cable or wireless transceiver, please refer *Electrical installation* on page *47*.

Setting up I2I interface for 3-phase system configuration	
☐	Set I2I node addresses so that the are different for each unit. For example, 1, 2 and 3.
☐	From Menu -> Communication -> 3 phase monitoring, set the following parameters:

Setting up I2I interface for 3-phase system configuration	
☐	74.01 Node address. Set the node address of the inverter to match the AC grid phase. For example, phase L1 to address “01”, L2 to “02” and L3 to “03”.
☐	75.01 Enable 3 phase monitoring. 0=disabled, 1=enabled.
☐	75.02 Normal operation. 0=do not limit power, 1=limit power.
☐	75.03 Comm timeout limit. 0=no timeout supervision, 1-255=comm. loss duration before timeout action is invoked (seconds).
☐	75.04 Comm timeout action. 0=limit power, 1=disconnect from grid.
☐	75.05 Device fault time. Device fault duration of another inverter before device fault action is invoked.
☐	75.06 Device fault action. 0=limit power, 1=disconnect from grid.
☐	75.07 Grid fault time. Grid fault duration of another inverter before grid fault action is invoked.
☐	75.08 Grid fault action. 0=limit power, 1=disconnect from grid.

Note: When I2I link is in use, the multiunit view should show the combined data for all three inverters.

Setting up the embedded fieldbus interface for remote monitoring	
☐	The node addresses need to match the slave addresses with which the monitoring system communicates.
☐	From Menu -> Communication -> Embedded Fieldbus, set the following parameters:
☐	58.01 Protocol enable. Select Yes or No.
☐	58.03 Node address. Set the inverter’s node address. For example, if there are 9 inverters in the system then set node addresses from 01...09.

9

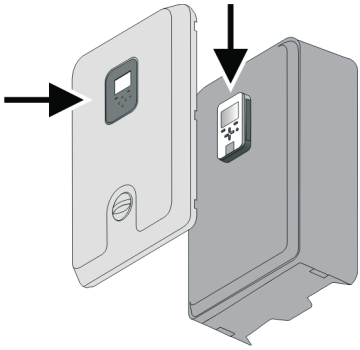
Operation

What this chapter contains

This chapter describes the operating modes, operation of the control unit, the information shown by LEDs and the graphical display.

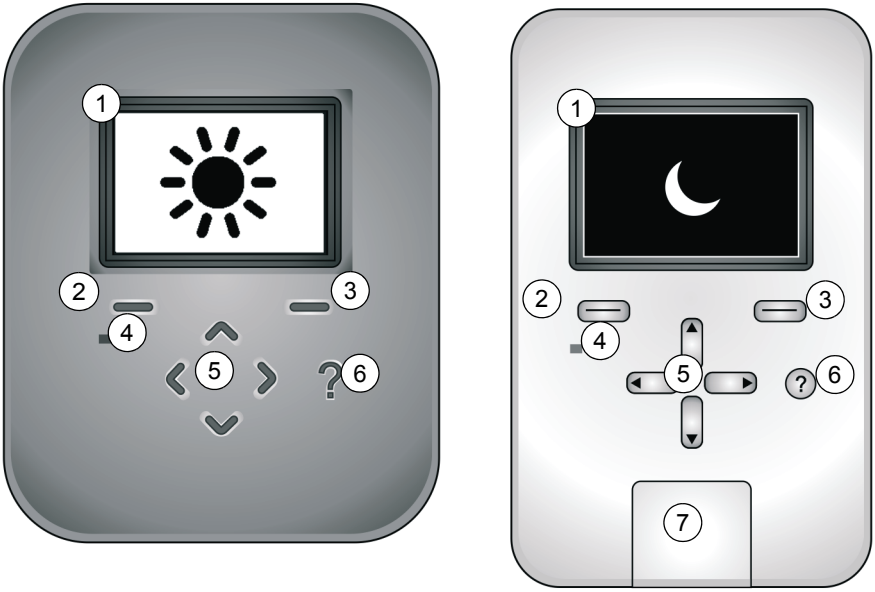
The inverter user interface

The control unit sits behind the front panel. Normally, the inverter is controlled using the buttons on the front panel which activate the corresponding buttons on the control unit. However, the control unit can be fitted to a remote location and, in that case, the inverter will be controlled using the control unit buttons.



Front cover on

Front cover off

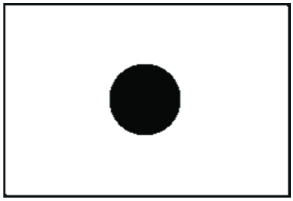
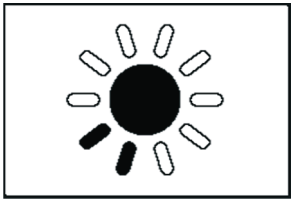


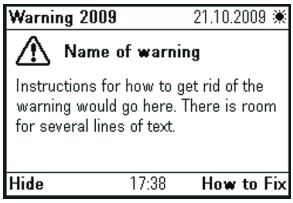
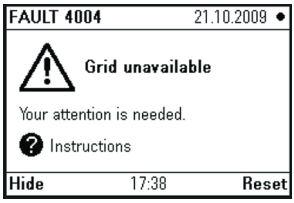
No.	Description
1	Graphical display
2	Left softkey
3	Right softkey
4	Status LED, dual color green or red
5	Up/Down/Left/Right arrow keys
6	Help key
7	USB connector and lid (for use by service only)

The inverter's main user interface is a control unit, featuring buttons, LEDs and an LCD graphical display. Additionally, there are status LEDs on the inverter control board which can be seen when the control unit is removed.

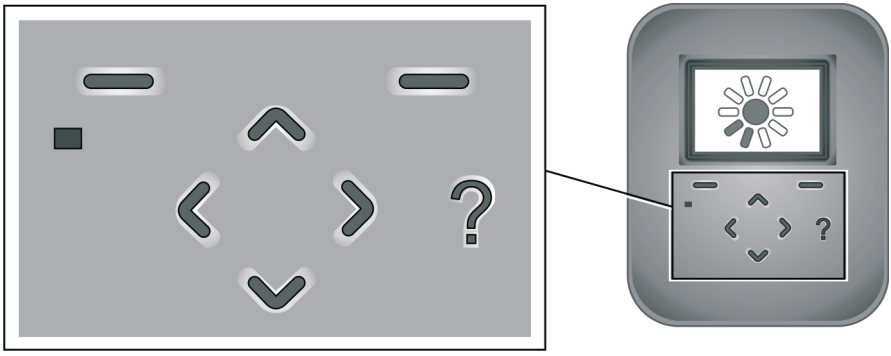
For information on the use of the panel, see chapter *Navigation map* on page *109*.

The operating modes of the PVS300 string inverter

Operating status	Example graphical display	Description
Sleep		This is a low power consumption mode in which only essential electronics use power. The inverter enters sleep mode when the DC input voltage is below a threshold value and there is no control unit activity during the threshold time period. The power meter shows “-- kW” when the inverter is going to sleep.
Stand-by		From sleep mode, the inverter switches to stand-by mode if the DC voltage rises above the threshold value or if there is control unit activity (wake up call by the user). In stand-by mode, the inverter performs continuous monitoring and the testing required for safe grid connection. The power meter shows “-- kW” when the inverter is on stand-by. **Note:** During stand-by operation the inverter can draw power from the solar array or the electrical grid.
Normal operation		The inverter has established a grid connection. The solar array is producing adequate electrical power which is being fed to the grid. The rays of the sun are used to show the current output power level Check output view of the control unit. The power meter shows the output power in the form “x.xx kW” when the inverter is in normal operation.
Limited operation	 **Note:** Like Normal operation but less of the sun’s rays are filled.	The inverter is operating with a limited power output. Check events from the control unit. The power meter shows the output power in the form “x.xx kW” when the inverter is in limited operation. The control unit’s LED flashes green during limited operation.

Operating status	Example graphical display	Description
Warning		The inverter has temporarily entered the stand-by mode. Normal operation will resume automatically if the cause of the warning is temporary, for example if there's a temporary power outage of the AC grid. Check events from the control unit. The power meter shows "-- kW" when there is a warning.
Fault		The inverter has entered stand-by mode and user action is required to resume normal operation. Check events from the control unit. The power meter shows "-- kW" when there is a fault.

Control buttons



The buttons on the front panel or control unit are used to navigate the menus. Note that not all buttons are used in all views.

- The **up** and **down** direction buttons are used to scroll up and down to different items within menu screens and to adjust values. Briefly pushing the button selects the next row in the menu. Hold the button down to quickly scroll through the possible choices. In parameter setting views, simultaneously pushing the up and down arrows will restore the selected parameter to the default value.
- The **left** and **right** direction buttons are used to navigate to the previous (higher level) and next (lower level) menu screens respectively. They are also used to move the cursor horizontally during parameter editing.

- The **left softkey** is used to select items shown on the bottom left of the display. This key is usually used for stepping backwards, for example to select *cancel*, *exit*, *no* and *back*. If held down, the left softkey exits each menu and nested view in turn, finally returning to the Output View. When the display shows the Output View, this button is used to toggle between numeric and graphical displays.
- The **right softkey** is used to select items shown on the bottom right of the display. This key is used to affirm, acknowledge and confirm, for example to select *yes*, *OK*, *proceed*.
- The **?** button is called the help button and is used to access contextual help screens.

Editing parameters

To edit a parameter, select the parameter name from the menu. Use the arrow keys to select/adjust each parameter, and the right softkey to save/confirm the selection.

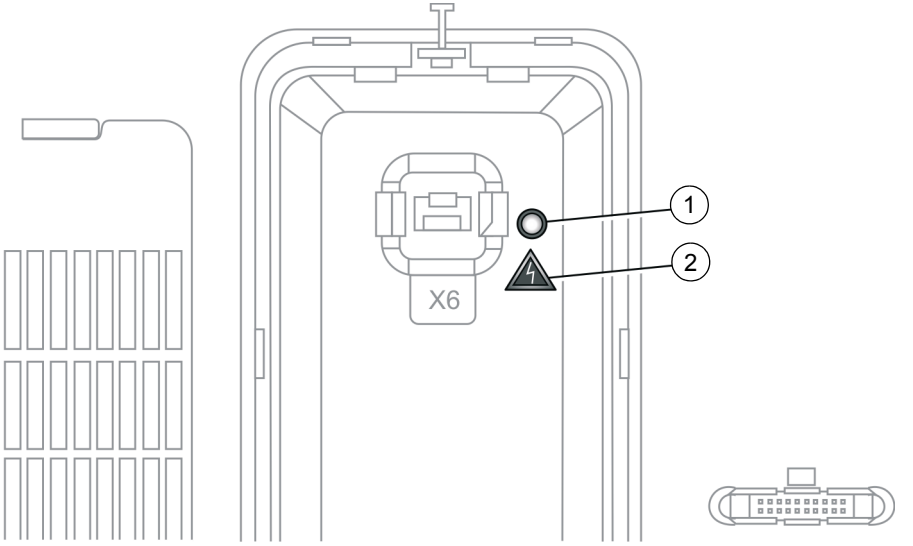
During parameter editing, pressing the up and down arrows simultaneously will restore the parameter to the default value.

LED indicators

The inverter has a control board with 2 LEDs and a control unit with 1 LED. The LEDs show the inverter's current operational status.

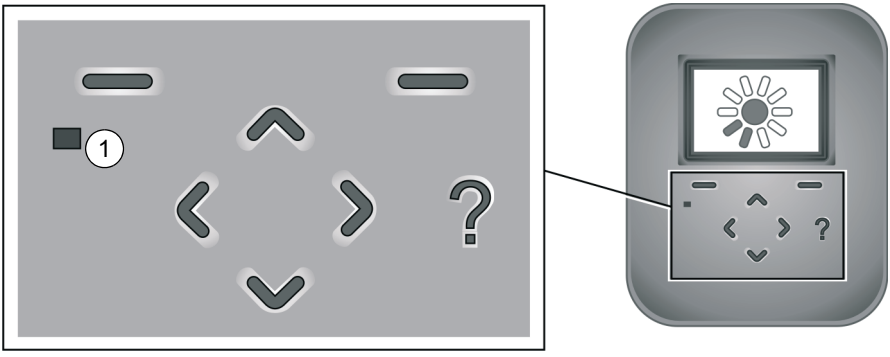
LEDs on control board

The LEDs on the control board can only be seen through the transparent section of the front cover when the control unit is not attached to the control board and inverter. For example, in cases where the control unit is remotely installed. The control board has one dual color LED (1) and one red warning symbol LED (2) which highlights active fault situations where there could be a danger of electric shock.



	LED Description and behavior
1	Operational status, red or green, OFF, ON or flashing.
2	Danger of electric shock, red symbol, steady ON if inverter has diagnosed an active ground fault.

LED on control unit



	LED Description and behavior
1	Bi-colour LED illuminates red or green. Can be OFF, ON or flashing. Indicates the operating status, warnings and faults.

LED status indications

Status	Control unit bi-colour LED	Control board LEDs	
		Dual colour LED	Red fault LED
Going to sleep	OFF	OFF	OFF
Fault	ON Red	ON Red (fault can be reset) Flashing Red (requires DC and AC disconnection to reset)	ON only if there is an active ground fault
	The inverter has an active fault requiring user action to reconnect to grid		
Warning	Flashing Red (1s ON, 2s OFF)	Flashing Green	OFF
	The inverter has an active warning and is temporarily in stand-by mode		
Stand-by	Flashing Green (1s ON, 2s OFF)	Flashing Green	OFF
	The inverter is in stand-by mode with no faults present		
Limited operation	Flashing Green (3s ON, 1s OFF)	ON Green	OFF
	The inverter is in power feeding mode with limited power output		
Normal operation	ON Green	ON Green	OFF
	The inverter is in power feeding mode		

Graphical display

The graphical display is used to show:

- Operational status
- Menus which can be navigated by the user
- Performance monitoring
- Event messages (for example, faults, warnings, maintenance reminders)
- Help

Refer to chapter *Start-up* on page *65* for details of the settings which must be made using the graphical display the first time the inverter is started up.

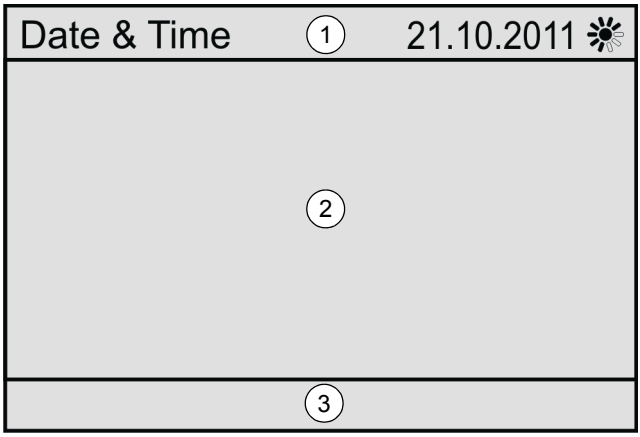
Refer to chapter *Navigation map* on page *109* for a map showing the inverter menu hierarchy. The menu hierarchy includes: **Start up assistant, Output view**, and **Menu View**.

The Help view appears when the Help (?) key is activated.

The Parameter view appears when parameter Edit is selected from Menu.

The Message view appears when an event, such as a fault, is activated.

Common display zones



1	**Status bar**	Includes the heading of the current view, the date and the status icon (sun, moon etc.). Not shown in special screens.
2	**Content area**	Different for each view. It displays the actual subject matter of the current view, be it a menu, a parameter, a help page etc. The details are included in the descriptions of each view.
3	**Softkey bar**	The Softkey bar shows the labels of the Softkeys, and the real time clock, if enabled. The labels change from view to view and are Not shown in special screens.

Note: In multi-unit installations, information in the Status and Softkey bars applies to the whole system. Information about individual devices cannot be viewed with the panel.

The status icon shows the current state of the inverter.

Icon	Inverter state	Note
	Operating	Device is in normal operating mode, feeding energy to the grid.
	Standby	Device is in standby mode without connection to the power grid.

Icon	Inverter state	Note
	Sleep	Device is in sleep mode.

Start up assistant

The **Start up assistant** appears automatically when the inverter is first installed. This menu guides the user through the settings for language, date, time and installation country.

Note: The installation country is permanent once the setting has been confirmed. If you need to change the installation country, contact your ABB partner for advice.

If necessary, these parameters, except for installation country, can be adjusted later.

See *Start-up* on page *65* for the setting procedure.

Output view menu

This menu shows the status and history of power produced by the system. In most screens the user can toggle back and forth between numeric and graphical histogram views to suit the user's preference.

This is the "home" screen, from which the **Menu** is accessed. It is also normally the view that appears when the inverter is powered on and it detects user interaction. The Sun Display appears automatically when the control panel is not touched for a while (default 3 minutes).

In multi-unit systems, it is possible to choose whether to show the combined output of all units.

The histograms show one column per hour, day, month or year. The current column is always shown in a different shade to the others.

Use the left and right arrow keys to choose between different time periods.

In the **Output: Today** view, the number in the upper right corner of the graphical content area shows the cumulative value of energy produced during the day so far. The number in the upper left shows the current output power in kW. If the inverter is disconnected from the grid then "-- kW" is shown. If the inverter is connected to the grid but is not feeding power, "0 kW" is shown.

The format (12 hour or 24 hour) of the time points below the graph initially depends on the geographical location of the unit. The format is user selectable from the Date and time menu.

In the **Output: This week**, **Output: This month**, **Output: This year**, and **Output: 24 years** views, the number in the upper right corner of the graphical content area

shows the cumulative value of energy that has been produced during the week, month, year and 24 years respectively.

The **Total** page shows cumulative values since the unit was installed. The *Energy output* and *Operation time* headers and values are always shown. The *CO_2 reduction* header and value are shown only if a reduction standard has been selected in the settings.

The **Technical information** page shows values that are only of interest to technically oriented users. Use the down arrow to access the technical information page.

The **Sun display** shows the current state of the unit and the output power in graphical format. See *The operating modes of the PVS300 string inverter* on page *73* for examples. Use the up arrow to access the sun display.

When the unit is in power feeding mode, a full sun and ten rays are shown. The rays are filled and empty in proportion to the current output power. For example, if half of the rays are filled, the unit is operating at 50% output power.

Menu

Menu is the main menu from which the user can change parameters and access event logs. The different features are accessed through a hierarchical navigation structure of submenus.

Used for displaying a list of settings or selections which can be scrolled.

Date & time submenu

Used to set the time and date as well as to choose the display format.

The user must select Daylight saving OFF/ON from the **Date & time** menu.

Screen submenu

Used to set the screen brightness, contrast and screensaver delay

By default, the display backlight is ON when the inverter is in operating mode. When the inverter is in sleep mode, the control unit and display switch OFF completely. The control unit wakes up and the backlight illuminates if the keypad is activated.

If the keypad is not used for a preset time when the inverter is in operating mode, the Sun display shall appear automatically.

The user can set the reduced backlight function ON/OFF to dim the backlight when the keypad is not used for a preset time period. The reduced backlight function is mainly designed to be used when the Control unit is remotely mounted, for example on a bookshelf in a residential house.

Events submenu

This is subdivided into two menus, one for faults and the other for events. In both cases the view shows the date and nature of the fault or event. Push the Help (?) button to see any available additional information about the event.

Events remain in the event log even after the faults have been solved. The inverter automatically removes the oldest items from the event log when there is insufficient memory to store new events.

Communication submenu

Contains the parameters that are needed to set up communication to other systems.

The purpose of the menu is to show a subset of the parameter groups which are used to set up communications. Panel communication parameters shall be accessible in this submenu. Other parameter groups are not accessible through this submenu.

If there are any assistants for communications settings, they shall be accessible through the communications menu.

System submenu

System information includes viewing a subset of parameter groups that tell the inverter type code and SW version.

Special screens

Special screens appear in situations where it is not applicable to show the device status. These screens are characterized by the lack of a status bar and softkey bar.

The Special screens include:

- The boot screen which appears when the control unit is connecting to the inverter.
- The splash screen which appears while the user interface is loading.
- The connection failure screen which indicates that the control unit and inverter are not communicating properly.

Messages

Messages indicate the presence of a fault, warning or maintenance reminder. They typically consist of one view, which appears automatically when a particular event happens.

Displays a problem in operation. Push the left softkey to hide/clear the message from the screen.

If there are several active messages, the user must hide/clear the most recent message to see any other active messages.

Help

Help pages contain context-sensitive problem-solving instructions and descriptions of functions and parameters. Press the Help (?) button to display the help page, if there is one, for the currently selected fault, menu item, parameter etc.

Progress indication

A progress bar is shown whenever the panel is busy. The user interface cannot be operated while the progress bar is showing. The progress bar automatically disappears when done.

10

Maintenance

What this chapter contains

This chapter explains the routine maintenance actions for the inverter.

General about maintenance

The inverter is a high-quality product which is designed to require very little maintenance and downtime. In the event of a problem or malfunction in the system, the built-in monitoring diagnostics are designed to highlight the nature of the problem or required maintenance action. With optional accessories, remote monitoring can be implemented by using the embedded fieldbus interface and the SREA-50 Remote monitoring adapter.

Only a limited number of parts can be replaced. Replacement fans can be delivered quickly through your installation company or local ABB service. In the event of severe damage, the whole inverter will usually need to be replaced. In case of severe inverter damage or an unidentified fault, please contact your installation company or local ABB service.

Self-diagnostics

The inverter self-diagnostic functions are active by default. They are designed to warn the user of maintenance triggers, faults, etc. For example, they tell you when to change the fans, fuses and surge protection varistors.

In the unlikely event that the self-diagnostic feature fails, the whole inverter will need to be replaced.

Requirements for maintenance personnel

The maintenance person is typically the building or solar system caretaker. For residential systems, the maintenance person is often the building owner. During commissioning, the commissioning electrician must teach the maintenance person the maintenance procedures and explain the easiest way to order spare parts.

Maintenance procedures and intervals

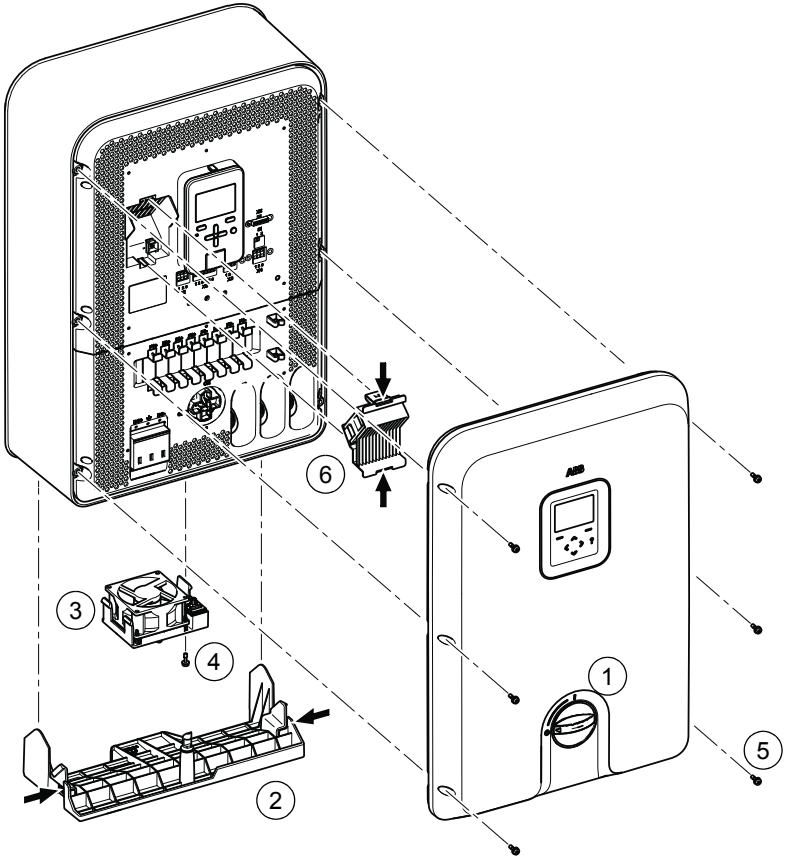
The table below lists the routine maintenance intervals recommended by ABB.

The maintenance intervals are suggested for a typical inverter, in a typical location for a typical operating duration. Maintenance intervals should be reduced if, for example, the inverter is located in a relatively harsh environment (non-standard installations or installations continuously operating under extreme environmental conditions).

Interval	Maintenance action	Instruction
Weekly	**Check event log**	Use the control panel to check the event logs from the Event Menu. The menu shows the most recent events as faults or other events. Note that a single fault can potentially give rise to several events. Events are stored in the memory until the event memory is full. When the event memory is full the inverter automatically removes the oldest events from the event memory.
Weekly	**Check operation of the cooling and stirring fans**	Check the device temperature from the Technical view of the control panel. The temperature should stay below 70 °C (158 °F). Check the Events menu for possible fan faults. The inverter activates a maintenance reminder when both fans (cooling and stirring) should be replaced. Note that the cooling fan only operates when the inverter detects that cooling is required. Change the fan(s) when the inverter displays a fan fault or a replacement reminder.
Monthly	**Check the environment**	Make sure that the inverter is still in its intended operating environment. Check that the installation environment is still clean, dry, free of obstacles near to the inverter and that the ambient temperature has not risen since installation.
Monthly	**Cleaning**	Clean the inverter installation space and mounting area regularly to remove dust and dirt. This helps to prevent clogging of the cooling fan and heat sink of the inverter.

Interval	Maintenance action	Instruction
Monthly (**Yearly** if the inverter is indoors with restricted access)	**Check connections**	Check that cables are properly routed to the inverter. Cables should be tidy, secure and in good condition. Check that connectors are properly connected and that they are in a safe, unbroken condition. Check that possible screw and spring terminal connections are tight.

Replacing fans



Replacing the cooling fan	
1	Turn off the main disconnector and circuit breaker(s) at the AC distribution board.
2	Turn the DC switch (1) on the front of the inverter to the OFF position.
3	If applicable, turn off disconnecting switches and circuit breakers between the inverter and solar array(s).
4	Pull the bottom cover (2) downwards.
5	Locate the cooling fan holder (3) in the middle of the underside of the inverter. Unscrew the locking screw (4) which holds it in place.
6	Pull the cooling fan holder downwards.
7	Insert the new fan and holder. Ensure that it is aligned correctly so that the fan connector engages with the receptacle.
8	Fit the locking screw to the fan holder.
9	Replace the bottom cover.
10	Turn ON the main disconnector and circuit breaker(s) at the AC distribution board.
11	Turn ON switches and circuit breakers (as applicable) between the inverter and solar array(s).
12	Turn the DC switch on the front of the inverter to the ON position.

Replacing the stirring fan	
1	Turn off the main disconnector and circuit breaker(s) at the AC distribution board.
2	Turn the DC switch (1) on the front of the inverter to the OFF position.
3	If applicable, turn off disconnecting switches and circuit breakers between the inverter and solar array(s).
4	Remove the front cover by removing the locking screws (5).
5	The stirring fan (6) is in the upper left corner. Pull the stirring fan holder towards you.
6	Insert the new fan and holder. Ensure that it is aligned correctly so that the fan connector engages with the receptacle.
7	Replace the front cover and locking screws.
8	Turn ON the main disconnector and circuit breaker(s) at the AC distribution board.
9	Turn ON switches and circuit breakers (as applicable) between the inverter and solar array(s).
10	Turn the DC switch on the front of the inverter to the ON position.

Available spare part kits

ABB material code	Material description
3AUA0000090483FAN KIT PVS300	Cooling fan spare part kit
3AUA0000090484FAN KIT PVS300	Stirring fan spare part kit

11

Troubleshooting

What this chapter contains

This chapter explains how to replace inverter components. It also presents the possible malfunction indications and symptoms along with the corrective actions.

Replacing string fuses

1. Switch OFF the DC switch on the inverter.
2. Remove the front and bottom covers. See section *Removing and replacing the front cover and bottom cover* on page *41*.
3. Perform at least one of the following actions:
   - Switch off all disconnecting switches and circuit breakers on the DC side.
   - Disconnect all DC cable connectors from the inverter.
4. Check the condition of the solar array and string cabling. Make sure that there is no damage.
5. Check that the sizing of the solar array and string cabling is correct.
6. One by one, check both fuses for each string input which is in use. See *Layout drawing* on page *23*. Pull open the respective fuse holder and remove the fuse. Check the fuse with a continuity tester.
7. Check that the nominal rating of the fuses is correct. Replace all incorrect fuses with correctly rated solar fuses.
8. Replace faulty string fuses with solar fuses of the same type and rating.
9. Record the date and position of changed fuses. Further troubleshooting is required if the same fuse blows repeatedly.
10. If a fuse is faulty, carefully check the relevant string for faults.

11. Push the fuse holders back into position.
12. Repeat steps 7 to 11 for all string inputs in use.
13. Reconnect all DC cables to the corresponding inputs on the inverter.
14. Replace the front and bottom covers. See section *Removing and replacing the front cover and bottom cover* on page *41*.
15. Perform the following applicable actions:
    - Switch on all disconnecting switches and circuit breakers on the DC side.
    - Switch ON the DC switch of the inverter.
16. Check that the inverter resumes normal operation.
17. Monitor the inverter for a few days to ensure that it is working correctly.

Replacing the surge protection device

The surge protection device has 3 cartridges which are consumable parts. When a DC side voltage surge occurs, e.g. because of thunder storm at the area, the SPD cartridge might worn out. Worn out cartridge's indicator turns from green to red and inverter shall give warning code 1001. Cartridge with red condition indicator must be replaced to ensure further functioning surge protection.

1. Turn the inverter's DC switch to '0'.
2. Remove the front cover. See section *Removing and replacing the front cover and bottom cover* on page *41*.
3. Check the condition of cartridges. See *Layout drawing* on page *23*. Is the indicator green or red?
4. Replace cartridges which have a red indicator with new ones of the same type.
5. Replace the front cover. See section *Removing and replacing the front cover and bottom cover* on page *41*.
6. Turn inverter's DC switch to '1'.
7. Reset the active 'Replace SPD' warning.
8. Check that the inverter resumes normal operation.
9. Monitor the inverter for a few days to ensure that it is working correctly.

Replacing the inverter

If the inverter needs to be replaced, follow the decommissioning and installation procedures. There is no need to transfer components from old product to new.

Where the inverter is returned and replaced under warranty, there is no need to return the fuses or surge protection cartridges.

Fault messages

Fault message ID code	Fault message description	Causes of fault and corrective actions
1	Overcurrent	Inverter has performed overcurrent trip and has disconnected from the grid. Possible causes for overcurrent peak are an AC side short-circuit, other sudden AC side voltage drop or inverter malfunction. Check if the AC side circuit breaker for inverter output protection in electrical distribution board has also tripped. If yes, your electrical system should be checked by an electrician. Report behavior to your system supplier. If not, try to reset the fault from control unit. Power down the inverter: Turn DC switch to '0' and AC side circuit breaker to OFF position. Wait until DC bus voltage drops below threshold 250V and the control unit switches OFF. Restart the inverter: turn DC switch to '1' and AC circuit breaker to ON position. Monitor the inverter for few minutes to see if inverter returns to normal operation. If inverter returns to normal operation; monitor the inverter's operation carefully for a few days If the fault occurs frequently; record the event's date & time, inverter's serial number and inform your system supplier
2	DC bus overvoltage	Inverter has diagnosed high DC voltage. Check and record the DC voltage reading from Technical information page. If it is still over 900 V, turn DC switch to '0' position, now the DC voltage on Technical Information view should start to drop. If the DC voltage is not dropping; pull out the bottom cover and disconnect all of the DC quick connectors. Alternatively, switch OFF all possible external DC switches or circuit breakers. If the fault is on but DC voltage reading is under 900 VDC, try to reset the fault and monitor if the inverter returns to normal operation or not. If inverter returns to normal operation; monitor the inverter's operation carefully for a few days Record the event's date & time and inform your system supplier about inverter behavior, because your system might have too many solar panels in series.

Fault message ID code	Fault message description	Causes of fault and corrective actions
4	DC cap overvoltage	Inverter has diagnosed too high DC capacitor voltage caused by imbalance between upper and lower capacitors. Check and record the DC voltage reading from Technical information page. If the fault is ON and DC voltage reading is inside allowed range, try to reset the fault and monitor if the inverter returns to normal operation or not. If inverter returns to normal operation; monitor the inverter's operation carefully for a few days. If the fault occurs frequently; record the event's date & time and inform your system supplier or your local ABB service about inverter behavior.
16	Ground fault	Inverter's RCMU has diagnosed leakage current to the ground during inverter's power feeding operation and has disconnected itself from the electrical grid. Leakage current can be result of human, animal or other object's contact to faulty cabling and ground. Leakage current can also be caused by faulty inverter, other faulty electrical device or cabling causing contact to the ground. Power down the inverter: Turn DC switch to '0' and AC side circuit breaker to OFF position. Check that no people, animals or other objects are in danger or in touch with electrical parts of your solar system. Check visually that there are no faults or burn marks around the cabling of your solar system. Power up the inverter: Turn DC switch to '1' and AC side circuit breaker to ON position. If inverter returns to normal operation; monitor the inverter's operation carefully for a few days. If the inverter returns to 'Ground fault state', immediately power down the inverter: Turn DC switch to '0' and AC side circuit breaker to OFF position. Pull out the bottom cover and disconnect all of the DC quick connectors. Alternatively, switch OFF all possible external DC switches or circuit breakers. Disconnect the AC connector. Record the event's date & time, inverter's serial number and call your system supplier to an immediate service visit, because your solar system might have a dangerous AC or DC cabling isolation fault and contact to the ground.

Fault message ID code	Fault message description	Causes of fault and corrective actions
17	GND impedance fault	Inverter has diagnosed too low impedance (isolation fault) between DC+ or DC- bus of the inverter and the ground before establishing grid connection. Power down the inverter: Turn DC switch to '0' and AC side circuit breaker to OFF position. Check that no people, animals or other objects are in danger or in touch with electrical parts of your solar system. Check visually that there are no faults or burn marks around the DC cabling of your solar system. Record the event's date & time, inverter's serial number and call your system supplier to an immediate service visit, because your solar system might have dangerous DC cabling isolation fault and contact to the ground.
18	RCD fault	Fault detected in Residual current monitoring unit. Fault cannot be reset. Inverter must be replaced. Record the event's date & time and inform your system supplier.
21	Current measurement	Inverter has diagnosed measurement error in current measurement. Try to reset the fault and monitor if the inverter returns to normal operation or not. If inverter returns to normal operation; monitor the inverter's operation carefully for a few days. If inverter does not return to normal operation; Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier, because your inverter might have a hardware failure.
22	Redundant IGND fault	Inverter has diagnosed internal measurements redundancy fault. This is a HW fault and cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.
23	Redundant VAC fault	Inverter has diagnosed internal measurements redundancy fault. This is HW fault and cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.
24	Parameter rating mismatch	Inverter diagnosed parameter error. Record the event's date & time, inverter's serial number and inform local ABB service.

Fault message ID code	Fault message description	Causes of fault and corrective actions
25	PWR BRD ID fault	Inverter cannot detect the power board. This can be HW or SW fault which cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.
26	INV Overtemp. Fault	Inverter has performed over temperature trip and disconnected from the grid. Inverter's internal temperature has been rising over trip limit despite output current reduction function. Check the installation environment temperature. Check the DC bus voltage, inverter temperature value and appearance time of the fault from the Technical information. Note: The fault is resettable but activates immediately back if the inverter temperature has not been falling under the trip value. From Technical information or from Events menu=> warnings; check if warnings 1004 or 1005 have been active lately. Check if cooling fan is running and there is air flow coming out from the backside of the inverter. A DC voltage over 250V is required so that the fan will run. Check if stirring fan is running: Turn DC switch to '0', remove front cover, turn DC switch to '1', wait a few minutes to see if stirring fan starts running. A DC voltage over 250V is required so that fan will run. Check that cooling fan is clean: Turn DC switch to '0' and remove the bottom cover, remove cooling fan for inspection, clean, replace cooling fan to its position. Check that stirring fan is clean: remove stirring fan for inspection, clean, replace stirring fan to its position. Replace the front and bottom covers. Turn DC switch to '1' position, try to reset the fault and monitor if the inverter returns to normal operation or not. If inverter returns to normal operation monitor the inverter's operation carefully for a few days Record the event's date & time, environment temperature and inform your system supplier because system might have too many solar panels connected, too hot installation location or inadequate cooling air flow.

Fault message ID code	Fault message description	Causes of fault and corrective actions
27	CTLBRD Overtemp. Fault	Inverter has diagnosed control board temperature to be over trip limit and has performed over temperature trip and disconnected from the grid. Inverter's control board temperature has been rising over trip limit despite output current reduction function. Check the installation environment temperature. Check the inverter temperature and appearance time of the fault value from the Technical information. Note: The fault is resettable but activates immediately back if the control board temperature has not been falling under the trip value. Check if cooling fan is running and there is air flow coming out from the backside of the inverter. A DC voltage over 250V is required so that the fan will run. Check if stirring fan is running: Turn DC switch to '0', remove front cover, turn DC switch to '1', wait few minutes to see if stirring fan starts running. A DC voltage over 250V is required so that the fan will run. Check that cooling fan is clean: Turn DC switch to '0' and remove the bottom cover, remove cooling fan for inspection, clean, replace cooling fan to its position. Check that stirring fan is clean: remove stirring fan for inspection, clean, replace stirring fan to its position. Replace the front and bottom covers. Turn DC switch to '1' position, try to reset the fault and monitor if the inverter returns to normal operation or not. If inverter returns to normal operation monitor the inverter's operation carefully for a few days. Record the event's date & time, environment temperature and inform your system supplier because system might have too many solar panels connected, too hot installation location or inadequate cooling air flow.
28	INV Device fault	Inverter has diagnosed control error in power electronics. This is HW fault and cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.
29	REL fault	Inverter has diagnosed control error in one of the four AC grid disconnection relays. This is HW fault and cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.

Fault message ID code	Fault message description	Causes of fault and corrective actions
31	MCU CONN fault	Inverter has diagnosed internal communication error. This is HW fault and cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.
32	MCU UAC fault	Inverter has diagnosed internal measurements redundancy fault. This is HW fault and cannot be reset. Inverter must be replaced. Record the event's date & time, inverter's serial number and inform your system supplier.
33	MCU IGND fault	Inverter has diagnosed internal measurements redundancy fault This is HW fault and cannot be reset. Inverter must be replaced. Record the events date & time, inverter's serial number and inform your system supplier.
34	MCU DC input fault	Inverter has diagnosed reverse polarity or short circuit at DC terminals. Check if the warning ID 1000 is also active. If yes, check and replace all faulty string fuses. Power down the inverter: Turn DC switch to '0' and AC side circuit breaker to OFF position. Open the bottom cover and check that all the DC connectors are firmly at their correct positions and according to the cable markings. If no input connection errors are found or input cable markings are missing or not clear: Record the event's date & time, inverter's serial number and inform your system supplier to make service visit to check the correct polarity and order of all DC input connectors, and solar installation for possible short circuits or connection errors.
36	SW internal	Illegal SW function was detected. This is SW fault which cannot be reset. Inverter's SW must be updated. Record the event's date & time, inverter's serial number and inform your system supplier or your local ABB service.

Warning messages

Warning message ID code	Warning message description	Cause of warning and inverter's behavior	Maintenance or service person actions
1000	DC fuse blown	DC string fuse has failed. If there are several inputs connected and some of them without solar fuse failure; the inverter continues power feeding with partial solar power available from remaining functional strings.	Maintenance or service person should replace all failed string fuses.
1001	DCSS fail	Surge protection cartridge has failed. Inverter continues its normal functions; however inverter's protection level against voltage surges has decreased. If surge protection cartridges are not replaced, inverter might get damaged when next surge voltage peak appears at DC side.	Maintenance or service person should replace all failed surge protection cartridges.
1002	INV overtemp.	Inverter power electronics has reached high internal temperature level. Inverter temporarily adjusts its operation point to limit output current and power until internal temperature has decreased. Inverter returns automatically back to normal operation.	User should monitor the inverter temperature from control unit's technical view and report system supplier if warning appears often.
1003	CB overtemp.	Inverter control electronics has reached high internal temperature level. Inverter temporarily adjusts its operation point to limit output current and power until internal temperature has decreased. Inverter returns automatically back to normal operation.	User should monitor the inverter temperature from control unit's technical view and report system supplier if warning appears often.
1004	EXT fanfail	Cooling fan has failed. Inverter continues its normal functions, however it might often limit the output power or cause over temperature trips.	Maintenance or service person should replace the cooling fan and report to system supplier.
1005	INT fanfail	Stirring fan has failed. Inverter continues its normal functions, however it might often limit the output power or cause over temperature trips.	Maintenance or service person should replace the stirring fan and report to system supplier.

Warning message ID code	Warning message description	Cause of warning and inverter's behavior	Maintenance or service person actions
1006	EXT fan max. runtime	Inverter's software has calculated that cooling fan's reported lifetime by the fan manufacturer adjusted to inverter's actual operational environment has been reached. Inverter and cooling fan continues normal operation.	To minimize close future output power losses and service downtime; maintenance or service person should order the spare part and replace or prepare for replacement of the cooling fan.
1007	INT fan max. runtime	Inverter's software has calculated that stirring fan's reported lifetime by the fan manufacturer adjusted to inverter's actual operational environment has been reached. Inverter and cooling fan continues normal operation.	To minimize close future output power losses and service downtime; maintenance or service person should order the spare part and replace or prepare for replacement of the stirring fan.
1008	INV therm. fail	Both temperature sensors on the inverter's power electronics board have failed. Inverter continues its normal functions based on remaining functioning temperature sensors and SW calculations. However, the power output is continuously limited and system's performance is decreased.	User should check the serial number of the inverter. User should immediately report system supplier about the warning and organize service visit for inverter replacement.
1009	CB therm. Fail	Inverter's temperature sensor at control electronics board has failed. Inverter continues its normal functions based on remaining functioning temperature sensors and SW calculations. However, the power output might be often or continuously limited and system's performance is decreased.	User should check the serial number of the inverter. User should immediately report system supplier about the warning and organize service visit for inverter replacement.
2994	PBCOMM timeout	3-phase monitoring: Communication timeout of i2i link between 3-phase configured inverters. Inverter continues operation according 3-phase monitoring setup; parameter 75.04.	User should monitor for 10 min or so if the inverter returns to normal operation automatically or not. If not or if warning repeats often; user should immediately report to system supplier.

Warning message ID code	Warning message description	Cause of warning and inverter's behavior	Maintenance or service person actions
2995	PBREMOTE grid fault	3-phase monitoring: One of the inverter's connected to remaining AC grid phases has sensed instability of the 3-phase supply and has disconnected from the grid. Remaining operating inverters continue operation according to 3-phase monitoring setup, parameter 75.06, until instable phase returns functional.	User should monitor for 10 min or so if the inverter returns to normal operation automatically or not. If not or if warning repeats often; user should immediately report to system supplier.
2996	PBREMOTE device fault	3-phase monitoring: One of the inverters connected to remaining AC grid phases is faulty and has disconnected from the grid. Remaining operating inverters continue operation according to 3-phase monitoring setup, parameter 75.06, until faulty inverter has been replaced.	User should check the serial number of the faulty inverter. User should immediately report system supplier about the warning and organize service visit for inverter replacement.
2997	PBPARAM mismatch	3-phase monitoring: One of the three inverters connected together with I2I link has wrong 3-phase monitoring configuration compared to remaining inverters.	User should check and compare the 3-phase monitoring parameter settings between all three inverters connected together with i2i link. User should Inform the system supplier about warning and perform corrective settings according their instructions.

12

Decommissioning

What this chapter contains

This chapter explains how to remove the inverter from service and recycle it at the end of its lifetime.

Removing the inverter from service

1. Switch OFF the DC switch on the front panel of inverter.
2. Electrically isolate the inverter. See *Isolating the PVS300 inverter from external power sources* on page *11*.
3. Turn off all disconnecting switches and circuit breakers on the DC side.
4. Turn off the disconnecting switches and circuit breakers at the AC distribution board.
5. Remove the front and bottom covers. See *Removing and replacing the front cover and bottom cover* on page *41*.
6. Disconnect the AC cable connector.
7. Disconnect the DC cable connectors.
8. Disconnect auxiliary power cables (if applicable). The power supply from the external control equipment must be disconnected either with applied circuit breaker or power switch.
9. Disconnect control cables. The power supply from the external control equipment must be disconnected either with applied circuit breaker or power switch.
10. Ensure that disconnected cables are not left in a hazardous state.
11. Remove protective earthing connections (if applicable).

12. If applicable, remove the padlock from underneath the inverter.
13. Remove the locking screw from underneath the inverter.
14. Lift the inverter upwards and tilt it forwards, then lift it off of the mounting plate.
15. Remove the mounting plate from the wall.
16. Recycle the inverter and mounting plate responsibly.

WARNING! Do not open the inverter. Dangerous voltages may still be present inside, even after it is disconnected.

Recycling

Do not dispose of inverter with normal waste.

At the end of its operational lifetime, return the inverter to any recycling facility which receives and handles electronic goods. Alternatively, the product can be returned to ABB. Please contact your local ABB representative for shipping details.

13

Technical data

What this chapter contains

This chapter presents the technical data for the inverter.

DC Input data and solar requirements

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Nominal solar array power	3400 W	4200 W	4800 W	6200 W	8300 W
Maximum solar array power	3700 W	4500 W	5200 W	6700 W	8900 W
Operational voltage range, MPPT	335 V to 800 V				
Maximum solar array open circuit voltage	900 V				
Nominal operational voltage	480 V				
Wake up voltage	250 V				
Maximum solar array short circuit current	10.5 A	12.7 A	14.6 A	19.0 A	25.4 A
Number of MPP trackers	1				
Number of parallel input connections	4				
Connector type	Quick connector, Multicontact MC4, types PV-KBT4 (DC+) and PV-KST4 (DC-)				
Reverse polarity protection type	Short circuit diode, monitored				
Insulation monitoring	Impedance measurement between DC terminals and ground				
Surge protection	SPD between all DC terminals and ground, monitored				
Surge protection device type (SPD)	ABB, OVR PV 40 1000 P TS or Phoenix Contact, Type VAL-MS 1000DC/2+V-FM-UD				
Solar string fault current protection	Solar string fuse, 10x38mm, 1000 VDC All input terminals, monitored				

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Tested and approved solar string fuse types	Cooper Bussmann, PV-1…20A10F, 1000 VDC and Ferraz Shawmut, PV Fuse HP10M1…20A, 1000 VDC				
Solar string fuse nominal current rating	12 A Type Cooper Bussmann PV-12A10F included to inverter				
Solar string fuse maximum allowed nominal current rating	15 A	15 A	20 A	25 A	30 A
DC switch load breaking capacity	25 A at 1000 VDC (DC21B)				
Overvoltage category	OVC II				

AC Output data and grid requirements

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Nominal power	3300 W	4000 W	4600 W	6000 W	8000 W
Nominal current	14.3 A	17.4 A	20.0 A	26.1 A	34.8 A
Maximum current	15.6 A	18.9 A	21.7 A	28.3 A	37.7 A
Nominal grid connection	1/N/PE AC 230 V 50 Hz				
Grid earthing systems supported	TN-S, TN-C, TN-CS, TT (not corner earthed)				
Operating voltage range	180…276 V, range adjusted specifically for each country setting				
Operating frequency range	47…63 Hz, range adjusted specifically for each country setting				
Harmonic distortion of grid current	< 3%				
Power factor	1				
Protection class	Class 1				
Overvoltage category	OVC III				
Night consumption	<1 W				
Transformer type	N/A, no transformer				
Grid monitoring	Automatic grid relays, DC and AC sensitive residual current monitoring unit, anti-islanding functions according VDE V 0126-1-1:2006-2				
AC Connector type	Fixed plug, 3pole+PE, Phoenix Contact Variocon Power				
AC connector ratings	Maximum conductor size 16 mm2, Maximum current 70 A, Maximum voltage 690 V				
Recommended tripping curve type of external circuit breaker	Type B				
Minimum / (maximum) allowed nominal current rating of external circuit breaker	20 A / (63 A)	25 A / (63 A)	25 A / (63 A)	32 A / (63 A)	60 A / (63 A)

Environmental data and requirements

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Environmental category	Outdoor, wet locations				
Ingress protection class	IP55				
Pollution degree classification	PD3				
Acoustic noise level	< 45 dBA				
Ambient temperature range allowed during operation	- 25 … + 60 °C (- 13 … +140 °F)				
Maximum ambient temperature for nominal power output	+ 50 °C (+122 °F) In the ambient temperature range of 50…60 °C (122…140 °F), the output current is decreased according to temperature rise rate inside the inverter.				
Relative humidity level allowed, not condensing	0…100%				
Maximum installation altitude above sea level	< 2000 m				

Mechanical data

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Inverter dimensions Width / Height / Depth	W 392 / H 581 / D 242 mm				
Inverter weight	27 kg			29 kg	
Package dimensions Width / Height / Depth	W 470 / H 700 / D 295 mm				
Package weight	30 kg			32 kg	
Installation clearances Top / Sides / Bottom	T 250 / S 250 / B 500 mm				

User interface and communication data

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Control unit type	PVS-AP Graphical, detachable				
Control unit fixed mounting type	PVS-APK-F, optional accessory including surface and flush mounting frames				
Control unit mobile mounting type	PVS-APK-M, optional accessory including table stand and wireless communication kit				
Control unit communication	ABB control unit protocol over EIA-485				
3- phase monitoring	ABB inverter to inverter (i2i) protocol over EIA-485				
Remote monitoring communication	Modbus RTU protocol over EIA-485				

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Remote monitoring adapter type	SREA-50, optional accessory including graphical user interface, datalogger, Ethernet and GSM modem connectivity				
Programmable relay output	2A, 30Vdc/250Vac, electrically isolated Normally open or normally closed.				

Performance data

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
Maximum efficiency	96.8%	97.0%	97.0%	97.1%	97.1%
EU Efficiency					
345 V	95.7%	96.2%	96.1%	96.4%	96.9%
480 V	94.1%	94.9%	95.3%	95.6%	96.0%
720 V	92.8%	93.3%	93.6%	94.4%	95.2%
CEC Efficiency					
345 V	96.4%	96.6%	96.5%	96.8%	96.9%
480 V	95.3%	95.7%	95.9%	96.1%	96.3%
720 V	94.0%	94.5%	94.7%	95.2%	95.6%

Product marking and compliance

Inverter type PVS300-TL-	3300W-2	4000W-2	4600W-2	6000W-2	8000W-2
General safety in compliance with	EN50178:1997, EN62109-1:2010				
Grid safety in compliance with	VDE V 0126-1-1:2006-2, UTE C15-712-1, RD1663/2000				
CE conformity according to	LVD 2006/95/EC and EMCD 2004/108/EC; EN62109-1:2010 EN61000-2:2005 EN61000-3:2007				

Derating

The inverter monitors its internal temperature and derates the power output accordingly to protect the inverter, protection devices and cabling. Derating is fully automatic. While derating is active, if the inverter's temperature still rises or the operational currents are still too high, the inverter disconnects from the electrical grid to protect itself. When the internal temperature falls, the inverter automatically resumes power feeding.

The nominal output power can be achieved in ambient temperatures of up to 50 °C (122 °F). In the ambient temperature range of 50…60 °C (122…140 °F), the output power is derated.

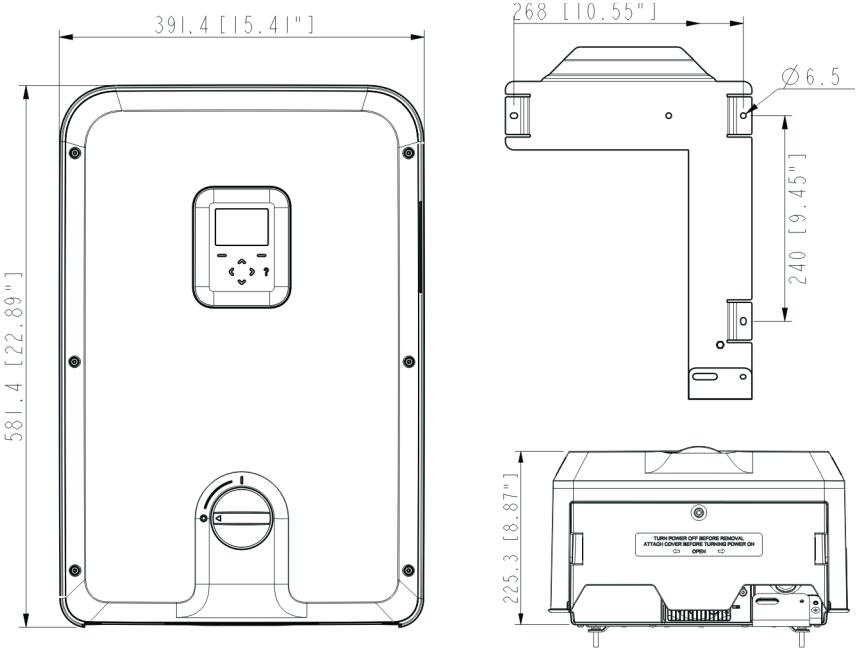
14

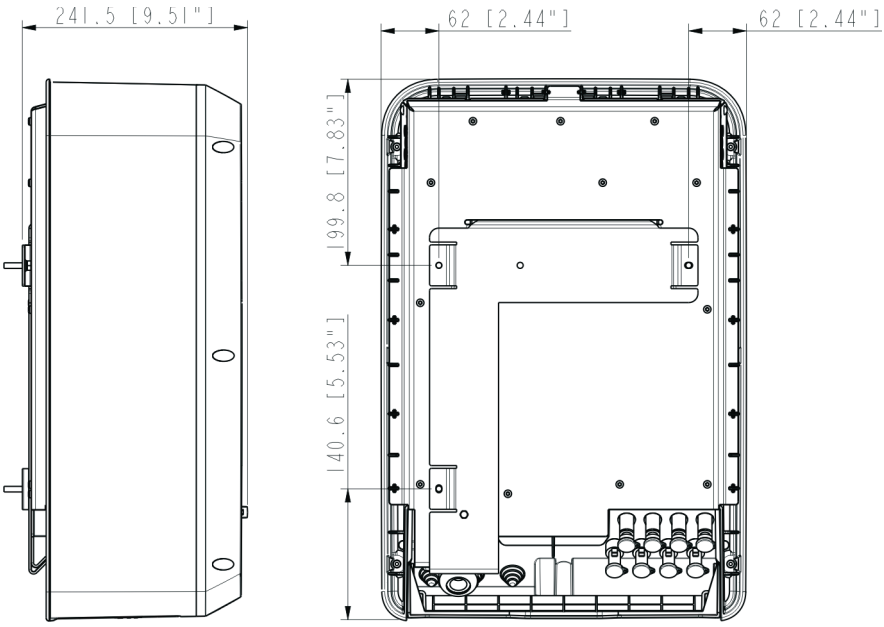
Dimension drawing

What this chapter contains

This chapter presents the external dimensions of the inverter and also shows the clearance dimensions to ensure that the inverter is properly ventilated.

Inverter dimensions

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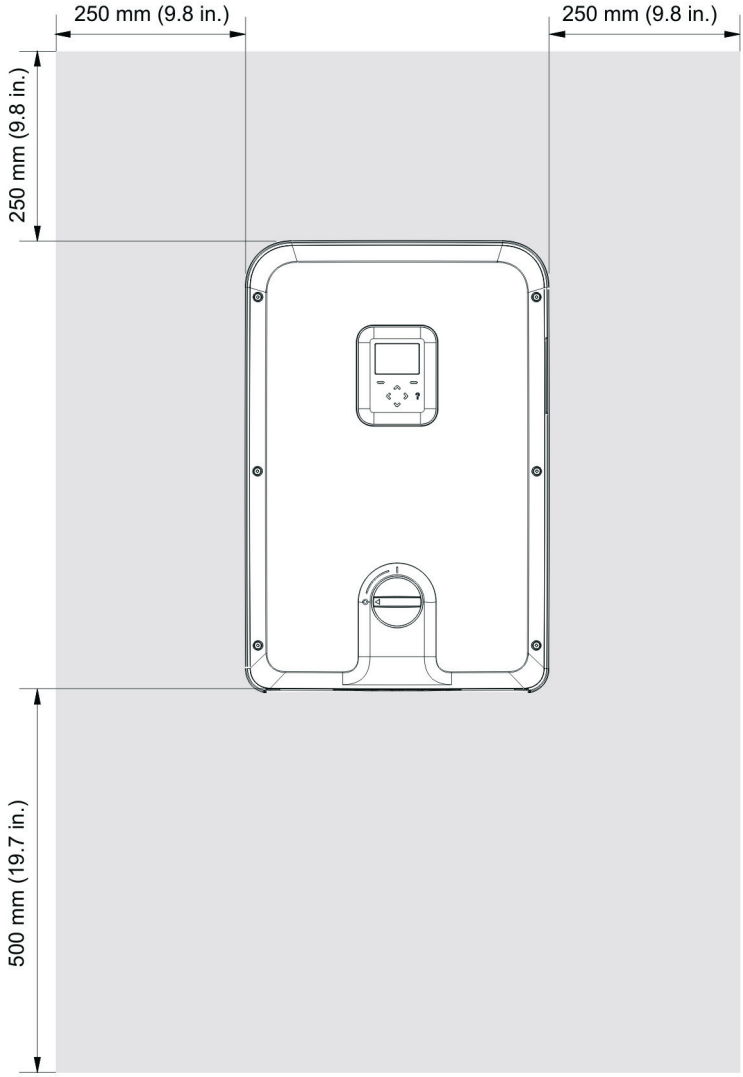
62 [2.44"]
62 [2.44"]
199.8 [7.83"]
140.6 [5.53"]

Required clearances for cooling



15

Navigation map

What this chapter contains

This chapter presents the navigation map in conjunction with instructions for how to read it.

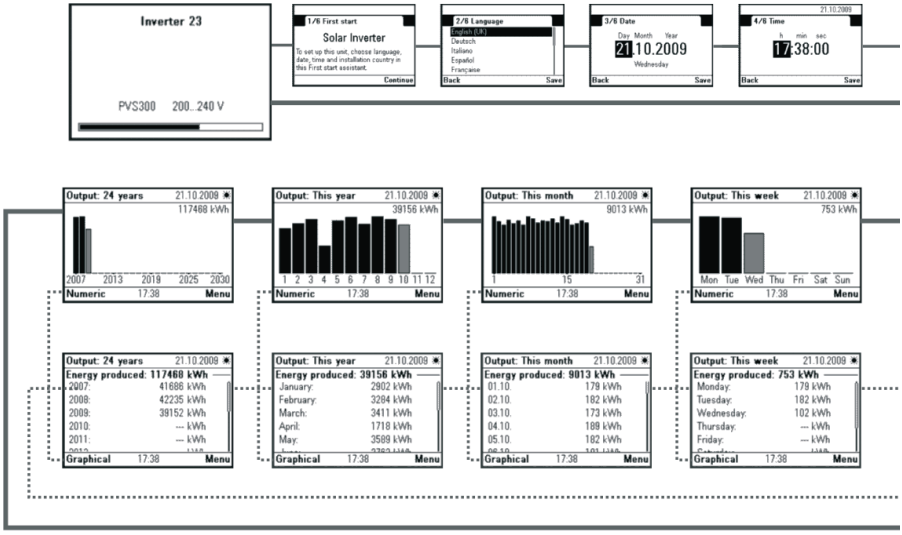
How to read the navigation map

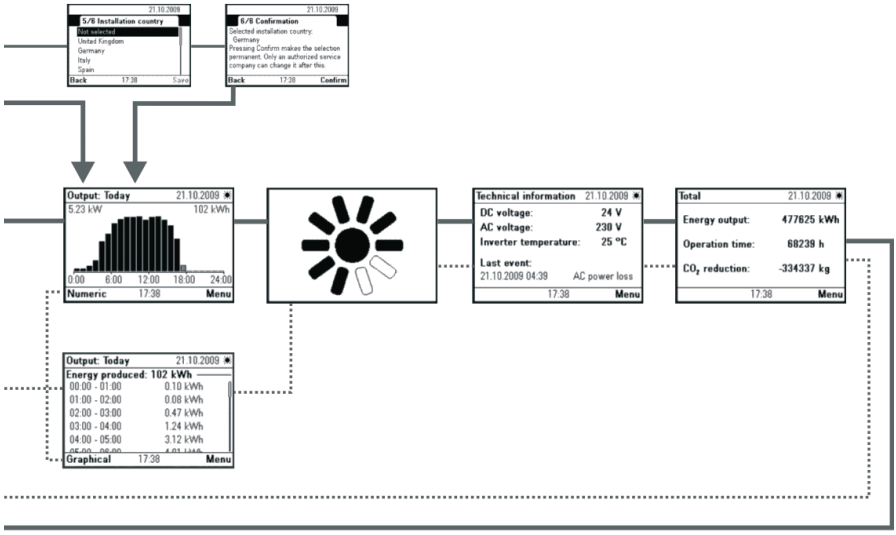
The top row of the navigation map shows the start-up sequence, from left to right, which is followed when the inverter is started up for the very first time.

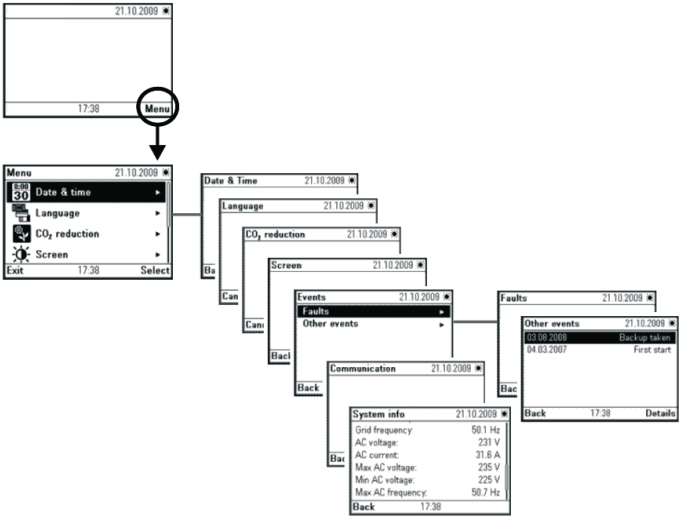
The second two rows are the ones which the user will see in normal operation. The user can cycle through these, forwards and backwards in an endless loop. For some of the screens the user can choose to view a graphical or numerical representation of the data.

After start-up, the user can access the Menu at any time to adjust settings and parameters. The menus are shown in the bottom rows of the navigation map.

The navigation map




S/8 Installation country
Not selected
United Kingdom
Germany
Italy
Spain
Back
Save
S/8 Confirmation
Selected installation country:
Germany
Pressing Confirm makes the selection permanent. Only an authorized service company can change it after this.
Back
Confirm
Output: Today
21.10.2009
5.23 kW
102 kWh
0:00
6:00
12:00
18:00
24:00
Numeric
17:38
Menu
Technical information
DC voltage: 24 V
AC voltage: 230 V
Inverter temperature: 25 °C
Last event:
21.10.2009 04:39
AC power loss
Total
Energy output: 477625 kWh
Operation time: 68239 h
CO2 reduction: -334337 kg
Output: Today
Energy produced: 102 kWh
00:00 - 01:00 0.10 kWh
01:00 - 02:00 0.08 kWh
02:00 - 03:00 0.47 kWh
03:00 - 04:00 1.24 kWh
04:00 - 05:00 3.12 kWh
Graphical


21.10.2009
17:38
Menu
Menu
Date & time
Language
CO2 reduction
Screen
Exit
Select
Date & Time
Language
CO2 reduction
Screen
Events
Faults
Other events
Communication
System info
Grid frequency: 50.1 Hz
AC voltage: 231 V
AC current: 31.6 A
Max AC voltage: 235 V
Min AC voltage: 225 V
Max AC frequency: 50.7 Hz
Back
Faults
Other events
03.08.2008 Backup taken
04.03.2007 First start
Back
Details

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/solar and selecting *Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/solar and select *Training courses*.

Providing feedback on ABB inverter manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet. Go to www.abb.com/drives and select *Document Library.* You can browse the library or enter selection criteria, for example a document code, in the search field.

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